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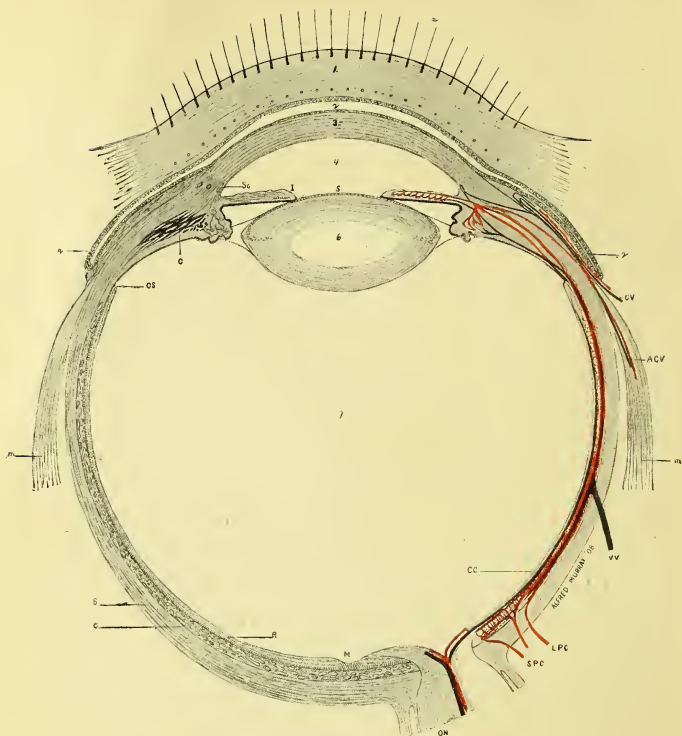


DIAGRAM--SHOWING HORIZONTAL SECTION OF THE EYE

- |   |                                      |
|---|--------------------------------------|
| 1. Lid with cilia and Meibomian orifices. | 4. Anterior chamber.                 |
| 2. Conjunctival sac.                      | 5. Pupil between two edges of iris.  |
| 3. Cornea.                                | 6. Lens supported by Zonule of Zinn. |
|   | 7. Vitreous.                         |

#### LEFT SIDE

- |                                      |                                |
|--------------------------------------|--------------------------------|
| Sc. Schlemm's canal.                 | m. Rectus muscle.              |
| I. Iris.                             | S. Sclera.                     |
| C. Ciliary body with ciliary muscle. | C. Choroid.                    |
| OS. Ora serrata.                     | R. Retina with macula lutea M. |
|                                      | ON. Optic Nerve.               |

#### RIGHT SIDE

- |                                |                                      |
|--------------------------------|--------------------------------------|
| CV. Conjunctival vessels.      | VV. Vena vorticiosa.                 |
| ACV. Anterior ciliary vessels. | LPC. Long posterior ciliary artery.  |
| m. Rectus muscle.              | SPC. Short posterior ciliary artery. |
|                                | CC. Choroidal capillaries.           |

# A SYSTEM OF OPHTHALMIC THERAPEUTICS

Being a Complete Work on the Non-Operative Treatment,  
Including the Prophylaxis, of Diseases of the Eye.

Edited and Chiefly Written

BY

CASEY A. WOOD, M. D., C. M., D. C. L.

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Illustrated and Completely Indexed

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TO THE MEMORY OF  
MY FRIEND AND TEACHER  
THE LATE  
FRANK BULLER, A. M., M. D.,  
FIRST PROFESSOR OF OPHTHALMOLOGY IN  
MCGILL UNIVERSITY.

To the preparation and experience needed in general medicine, must be added for proper treatment of troubles of the eye, knowledge which comes through physics, mathematics, and physiological optics. Henry D. Noyes, *A Text-Book on Diseases of the Eye*, 1890.

---

A man of genius has now and then become a great physician, like Hippocrates or Sydenham, by an acute and persevering observation of disease, and of the effects of remedies, and without much acquaintance with anatomy, yet the common voice of mankind proclaims that he who best knows the mechanism of the body will, with a like study of the other departments of medicine, be the best able to comprehend the actions of that body, both in health and disease. *Lectures on the Eye*, William Bowman, 1849.

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Die Geschichte der Medizin zeigt dieses nur zu deutlich, noch heute liegen sich Allopathen und Homöopathen, Hydropathen, Semmel-Hafer- und Wunderdoktoren, Magnetiseurs, schwedische Heilgymnastiker und Panaceenverkäuferinnen Haaren, jeder prahlt mit der Pracht and inneren Einrichtung seines, auf hölzernen Pfeilern in der Luft schwebenden Baues. Ein schwacher Luftstrom wirft ihn nieder, und ein neuer Baumeister fängt vom Frischen an, das Dach nach seinem Plane zu construiren, um es wieder bei dem nächsten Anstosse in kleine Theile zerstieben zu sehen.

*Die Ophthalmologie vom naturwissenschaftlichen Standpunkte aus*, Carl Stellwag von Carion, 1853.

---

Je sçais que la plûpart des chirurgiens négligent de s'appliquer aux maladies des yeux; parceque elles sont si nombreuses qu'on s'en fait un monstre, et que l'on croit qu'elles demandent toute l'application d'un homme, et une adresse toute singuliere pour exercer les opérations qui leurs conviennent. Il n'est rien de tout cela; elles sont nombreuses a la verité, mais elles sont très-faciles à apprendre à un chirurgien déjà éclairé dans sa profession. Antoine Maître-Jan, *Traité des Maladies de l'Oeil*, 1711.

---

Nell' arte di guarire i precetti senza esempi sono, per lo più, astrusi ed oscuri, e gli esempi senza precetti non fissano abbastanza l'attenzione degli studiosi. *Trattato delle Malattie degli Occhi*, Antonio Scarpa, 1816.

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# PREFACE

Although there are, in English several small monographs, mostly translations of foreign prints, on Ophthalmic Therapeutics, there is none in any language that gives a full account of the non-operative treatment of eye diseases from the earliest to the latest times. The present volume proposes to fill this gap in ophthalmic literature, especially from the standpoint of ocular therapy as it is practised in America.

In addition to a description, including their chemistry and pharmacology, of those agents that are therapeutically applied to the eye, several chapters are devoted to remedies that are commonly given internally in eye diseases. In considering external remedies I have endeavored to furnish their pharmaceutical relations, dosage, method of administration, contraindications and the opinions concerning them of those ophthalmologists who have given particular attention to their administration. In the same way are treated the various classes of ocular remedies—the astringents, cycloplegics, miotics, caustics, cauterants, antiseptics, germicides, analgesics, anesthetics, mydriatics, ciliary tonics, vasomotor constrictors and dilators, counter-irritants, etc.

Chapters are devoted to remedial forms, methods and appliances, blisters, liniments, vapors, ointments, collyria, pencils, tablets, discs, oily mixtures, sub-conjunctival medication, hypodermic injections, massage, local baths, compresses, bandages, eye-cups, medicine droppers, sprays, etc., etc.

Following these introductory chapters the individual eye diseases are taken up and the appropriate treatment of each of them is fully discussed.

In the text, cross references are frequently made to therapeutic agents mentioned, so that the reader may not only learn when some particular remedy is advised, but he may at once be acquainted with its chemical, pharmaceutical, and therapeutic relations—may learn what the remedy is, in what dosage, under what circumstances and how often it should be employed.

Even if the ophthalmologist does not himself treat those general conditions that give rise to or are associated with ocular affections he should be acquainted with the methods adopted by the surgeon or

internist who does. With this end in view, a number of gentlemen particularly capable of writing upon these subjects have contributed to this work.

Dr. A. C. Croftan, the well-known author of "Clinical Urinology" and "Clinical Therapeutics," has written several chapters on the conduct of those internal diseases (excepting those of the nervous system) that involve or are intimately connected with ophthalmic affections.

Dr. D'Orsay Hecht, Assistant Professor of Nervous Diseases in Northwestern University Medical School, has contributed much-needed chapters on the treatment of such affections of the brain and spinal cord as involve the eye.

Dr. Frank Allport, widely known as an authority on the subject, contributes to the section on Therapeutic Prophylaxis a chapter on the Examination of the Eyes of School Children.

Dr. Nelson Miles Black completes the above section by a contribution on the Precautionary Examination of the Eyes of Railway and other Corporations Employes.

Dr. Herman Peterson, Anesthetist to St. Luke's Hospital, Chicago, has written an important chapter on General Anesthesia in Ophthalmic Surgery.

Dr. W. Franklin Coleman, who has long made a study of the subject, has contributed chapters on the employment of various forms of Electricity in Diseases of the Eye.

Dr. Frank Brawley, whose investigations of the subject are familiar, has furnished an account of the treatment of those diseases of the nose and neighboring cavities that affect the eye.

Dr. Alfred Murray has supplied an entertaining and instructive chapter on the History of Ophthalmic Therapeutics.

Dr. Ernest E. Irons writes on that increasingly important subject—Serum Therapy in Eye Diseases, and its relation to bacteriology, opsonins, the opsonic index, etc.

In the preparation of this work I have naturally consulted many authorities on special and general therapeutics, among which I may mention the *National* and *United States Dispensatories*, the *British Pharmacopœia*, the "Extra" *pharmacopœia* and the pharmacal publications of the American Medical Association (especially those of the Council of Pharmacy and Chemistry). Among others may be instanced:

Ohlemann's *Treatise on Ophthalmic Therapeutics*, as edited by Oliver, Darier's *Thérapeutique Oculaire*, Snellen's chapters on *Die Augenärztlichen Heilmittel* in the last edition of the *Graefe-Saemisch Handbuch der gesamten Augenheilkunde*, several articles in the *Ency-*

*clopédie Francaise d'Ophtalmologie* and Hare's *System of Practical Therapeutics*—especially that small portion of it which I myself contributed.

I need hardly say that I have also found many valuable suggestions for treatment in the works of Noyes, Williams, Norris and Oliver and Roosa.

As my chief purpose has been to reflect, as nearly as possible, the present consensus of American opinion regarding the non-operative treatment of eye diseases, I have not hesitated to make use of the *Ophthalmic Treatises and Text Books* of my friends, deSchweinitz, Jackson, Posey, Webster Fox, Hansell, Duane (Fuchs), Mittendorf, Theobald, May, Colburn, Oliver, Tiffany, Ball, Gibbons and Wright, to all of whom I extend my grateful acknowledgments and thanks. It will also be noticed that I have quoted a number of other American, British and Continental authors.

As regards the treatment of the average example of the commoner diseases of the eye I have drawn largely upon the text-book written by Dr. Thomas A. Woodruff and myself.

I have also placed under contribution the admirable *Year Book of Ophthalmology* edited by deSchweinitz, Jackson and Schneidemann, as well as an annual volume on Eye Diseases which (forming part of the *Practical Medicine Series*) happens to be under my own editorial care.

I am particularly indebted to the abstracts in "*Ophthalmology*," the "*Annals of Ophthalmology*," the "*Archives of Ophthalmology*," and the *Zeitschrift für Augenheilkunde*, as well as to the reviews in the "*Ophthalmoscope*." The editor of the last named journal, Sydney Stephenson, has written the most interesting and complete account of recent ophthalmic therapy that has yet appeared in any periodical. I am much in his debt for a number of useful and practical observations that I have incorporated in this work.

For the definition of some remedial forms I am indebted to Thornton's *Dose-Book*.

To the long list of other periodicals and monographs in our own and other languages of which a work like this necessitates consultation I need not refer. A few of them are quoted in the text and in a short bibliography.

As to the pharmacology of the subject I am under obligation for valuable information derived not only from the sources mentioned but from Merck's *Index and Annual Reports*, Wyeth's "*Epitome*," and from literature sent me by most of the wholesale manufacturing druggists in this country and Europe. Among the firms who have so



kindly assisted me I may mention Merck & Co., John Wyeth & Bro., Parke, Davis & Co., Burroughs, Welcome & Co., the Farbenfabriken of Elberfeld Co., Knoll & Co., Victor Koechl & Co., H. K. Mulford & Co., Schering & Glatz, Schiefflin & Co., F. Stearns & Co., and Armour & Co. These chemists placed a supply of medicinal agents at my disposal so that I might study and experiment with them at my leisure. I trust this System has profited by these opportunities.

I am the grateful debtor of those of my confreres who responded to my request for information regarding such remedial agents as they had found especially helpful in the treatment of diseases of the eye. I believe that without their assistance I would have omitted some remedies deserving of notice or, on the other hand, might have attached an incorrect value to others with which I am imperfectly acquainted. Finally, while it is practically impossible to notice every medicament employed by our profession I have spared no pains to give an account of all that can be fairly said to claim the attention of the practical ophthalmologist.

I wish to express my thanks to Dr. A. F. C. Herring for his care in compiling the index.

CASEY A. WOOD.

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# CHAPTER I.

## INTRODUCTION.

*Many Remedies Employed in Ophthalmology—Unnecessary Therapy—  
Ophthalmic Panaceas—Cineraria Maritima—Thompson's Eyewater  
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Measures—The Ophthalmologist and the General Practitioner—  
Terminology of Ophthalmic Words—The Eye in General Diseases—  
Therapeutic Aphorisms—The Importance of Diagnosis.*

### Abbreviations.

*loco, cit.*, in the place cited.

N. D., *National Dispensatory*.

N. F., *National Formulary*.

q. v., *quod vide*, which see.

p. c., personal communication.

P. B. or P. Br., *British Pharmacopœia*.

P. G. or P. Gr., *German Pharmacopœia*.

U. S. or U. S. P., *United States Pharmacopœia*.

In the main the rules that govern medication in disease of the ocular structures do not differ materially from those that experience has taught us to be most useful in general therapeutics. Inasmuch as in the eye one finds representatives of almost all the tissues, simple and complex, found in other parts of the body it is not difficult to believe that a world of remedies, pharmacopœial and domestic, have at one time or other been drafted into the service of ophthalmology.

The eye, like other human organs, has suffered in its therapy from the caprice of fashion and the desire for change. Remedies have been employed by ophthalmologists because they were being used on more or less similar organs elsewhere, because they were different from medicaments previously used and had all the charm of novelty, because they fitted in for the time with a prevailing therapy, physiological, anatomical or pathological, because some strong personality willed it so—and for no reason at all. Still, it is fair to say that, on the whole, the ophthalmic surgeon has exhibited considerable wisdom in his therapeutics. He has found out most of the strong as well as the weak points of both new and old remedies and, with commendable conservatism, has held to that which he found to be good, and has

rejected, or is in the process of rejecting, most of the useless or doubtful remedies.

In the following pages I have endeavored, when I had an opinion, a criticism or a suggestion that I considered worth the expression to give it for what it might be worth. In the same way I have endeavored to permit other men to speak for themselves.

**"Overtreatment" or Unnecessary Therapy in Eye Affections.**

There can be no doubt that both the ophthalmic surgeon and his patient suffer at times from undue eagerness on the part of one or both for active treatment, especially in acute cases. I am sure it is the experience of older men particularly that this is a tendency which ought to be curbed. Not only is the surgeon often anxious to "do something" but he is stimulated by a demand on the part of the patient or the patient's friends to exhibit some material agent that they both believe will help or cure the disease.

Moreover, the long continued use of drugs after their usefulness has waned or disappeared should be sedulously avoided. I have seen many a case that required only cessation of the attendant's activity to bring about a cure.

Bearing upon this question, or rather one aspect of it, are the sentiments expressed by Chas. E. Michel (p. c.) who, as the result of over 40 years' experience, does not use in any of the *acute forms of conjunctivitis*—specific included—any of the so-called "mild" astringents or germicidal collyria, and has only to congratulate himself and his patients on the remarkably good results obtained by invariably abstaining from irritating the supersensitive and already inflamed conjunctiva. To those who have not followed his practice for years the above will no doubt be startling, notwithstanding the assertion that his practice has justified it; hence a few words as to the reasons which led him to absolutely abandon the ordinary remedies may prove interesting. He holds that all astringents are primarily irritants to the conjunctiva and not curative in conjunctivitis, and do only a minimum harm, *after toleration has been established*. The various silver preparations used in the treatment of the inflamed conjunctiva enjoy the best reputation solely because, according to his views, they are the least irritating by reason of nature's safeguard, the salty tears, which instantaneously neutralize them and at the same time wash them from between the eyelids. The stronger the collyrium of any kind, the greater the flow of tears, and consequently the sooner is the eye freed of the offending solution. All germicidal collyria in use are more or less irritating, while they cannot possibly kill the germs in the very short time that the tears will permit them to remain



between the eyelids; indeed, he knows of no solution used in the eye (the strongest of them included) that will destroy the germs in question, short of immersion in them for hours at a time in the laboratory. Naturally, he cannot too emphatically condemn as useless, and at times pernicious, the modern practice of using strong collyria on the new-born babe. Whatever good that has seemingly resulted (according to statistics) is easily accounted for by the extra care and cleanliness exercised in such practice, in other words, by asepticism. He believes that in cases of conjunctivitis, *from the simple irritable eye to gonorrheal ophthalmia*, the tendency of these inflammations is to be self-limiting, provided all sources of irritation be removed.

Ophthalmic surgery has its *advertised panaceas*, as well as its numerous lay remedies, in common with other departments of medicine and surgery. Some of these are reliable agents and, "prescribed with brains," are among our most valued possessions, while others are inert or hurtful. Although it is not my purpose to furnish a complete list of self-prescribed compounds used in every country and lauded in every newspaper, still the educated ophthalmic surgeon should have a fair knowledge of the composition, physiologic and clinical effects of the eyewaters, etc., that are likely to come under his notice. Thompson's Eye Water, Witch-Hazel, Petit's Eye Salve, Murine, Osmosine, Salt Water, Actina, "Eye-Fix," boric acid solutions and, perhaps, yellow ointment, are the commonest popular mixtures the ophthalmologist is likely to hear about in America. In addition to these Europe furnishes "Chamilen Thee" (infusion of chamomile flowers), Romershausen's Eyewash (a weak tincture of fennel seed diluted with five times its volume of water), warm milk (human and other), and "American" vaseline.

"Actina" is a nostrum whose activity depends upon the exposure of the eye in a cup to the fumes of oil of mustard. The counter-irritation set up by it I have known to relieve asthenopic symptoms, but as "one end is used for the ear and the other for the eye" it does not need much penetration to find its place in ocular therapeutics.

*Cineraria maritima* (q. v.) generally comes in the form of a tincture and is practically inert except that it contains enough alcohol to act as a local irritant. Its use as eyedrops, combined with massage, is said to form the basis of many so-called "absorption cures" of cataract. I gave the supposed remedy a thorough trial over ten years ago and found it of no avail.

*Pulsatilla* (q. v.), to be taken internally, belongs to the same category.

The flowers of "Clarry sage"—*Salvia sclarea*—are made into an

*infusion* and used as a domestic remedy in various forms of "sore eyes," just as *chamomile* (q. v.) "tea" is employed abroad. The plant contains a small amount of tannin and volatile oil to which, presumably, its virtues are due.

A word as to the terminology employed in this System. In my humble judgment the spelling of words used by the English people throughout the globe very properly varies in different continents and even in small subdivisions of these continents. It is useless, therefore, to lay down an arbitrary spelling or pronunciation, especially in a work intended to circulate among English-speaking people generally. In consequence of this I have decided not to attempt uniformity of spelling either on the part of my collaborators or myself. It strikes me as unimportant whether cocaine is spelt with or without an "e," or whether we write it "*physiologic*" or "*physiological*," whether the second syllable of anesthesia is spelled with a diphthong, whether *center* terminates in *re* or *er*, or *tumor* in *or* or *our*. Each contributor has been allowed to do as he pleases in this regard.

Much the same course has been pursued in the matter of *weights and measures*. While it is assumed that every educated physician is as familiar with the apothecary's weights and measures as he is with those of the metrical system, I have generally given both, and there will certainly be found, not only in the following tables, but on almost every page of the sections devoted to drugs, plenty of examples of each system. To those unaccustomed to both systems I append the following simple and useful table of Approximate Equivalents:

<i>Solid.</i>	<i>Fluid.</i>
15 grains=1 gramme.	17 minims=1 cubic centimetre.
60 grains=4 grammes.	60 minims or 1 drachm=3.5 cubic centimetres.
1 ounce=(437.5 grains) 30 grammes.	8 drachms or 1 ounce=30 cubic centimetres.
1 pound=453.5 grammes.	20 ounces or 1 imperial pint=568 cubic centimetres.

#### Approximate Measures.

The *National Dispensatory* (p. 1720) says that "in Great Britain prescriptions are compounded by *weighing the solids and measuring the liquids*, and the same course is very generally followed in the United States; but on the continent of Europe weights alone are employed in the making of preparations as well as in the compounding of prescriptions. Medicines are, however, taken by familiar domestic measures, which are subject to considerable variations, but are usu-

ally estimated as having the following capacity:" I have added a few comparative weights and measures:

In the United States.		In France.
A teaspoonful	1 fluidrachm.....	5 grams of water.
A desertspoonful	2 fluidrachms.....	10 grams of water.
A tablespoonful	$\frac{1}{2}$ fluid ounce.....	15 grams of water.
A wineglass	2 fluid ounces.....	60 grams of water.
A glassful	5 fluid ounces.....	150 grams of water.
A teacupful	4 fluid ounces.....	20 grams of water.
A tumblerful	8 fluid ounces.....	240 grams of water.

The approximate measures by the *handful* (Fr. *poignée*) and pinch (Fr. *pincée*) are almost completely discarded, or employed only for the least active drugs.

#### Size of Drops.

"The measuring of small quantities of liquids by drops gives very uncertain and variable results, which are influenced by the viscosity of the liquid, the size, shape, and fulness of the vessel, the curvature of the lip, the temperature, the rapidity of dropping, and probably by other circumstances. As a rule, it may be said that aqueous liquids yield larger drops than those containing little or no water; but very different results are obtained with the same liquid dropped from different bottles, or even from the same bottle under different conditions; the differences amount frequently to 50, and occasionally to 200 per cent. For these reasons medicated liquids should not be ordered in drops, but preferably by weight or measure; and whenever it is desirable for the patient to take a medicine by drops, the dose may be approximated by estimating each minim to contain of—

Ether and ethereal solutions,  $2\frac{1}{2}$  to 3 drops.

Tinctures, alcoholic solutions, and volatile oils,  $1\frac{1}{2}$  to 2 or  $2\frac{1}{2}$  drops.

Medicated wines, 1 to  $1\frac{1}{2}$  drops.

Water and aqueous solutions,  $\frac{3}{4}$  to 1 drop.

"In order to avoid to some extent the discrepancies resulting from the dropping of liquids under various conditions, dropping-measures (*compte-gouttes*) have been constructed in France, yielding at 15 degrees C. drops of distilled water, 20 of which weigh 1 gm., at least within a limit of 2 per cent. The French Codex gives a table containing the weight of 1 drop, and the number of drops for 1 gm. of various liquids, dropped under the conditions stated, which may be summarized as follows:

"Number of drops for 1 gm. of the following liquids:

- 20.....Hydrocyanic acid, diluted sulphuric acid, aqueous solutions of the salts of metals and the alkaloids.  
 21-26.....Mineral acids, ammonia-water, glycerin, Fowler's solution, vinegars.  
 31.....Solution of chloral (1/3).  
 33.....Wine (Grenache) and medicated wines.  
 43.....Creosote.  
 48.....Fixed oils.  
 50-57.....Glacial acetic acid, carbolic acid (alcoholic solution), alcohol (sp. gr. .864 and over), chloroform, volatile oils, tinctures, spirit of nitrous ether.  
 61.....Alcohol (sp. gr. .834), tincture of iodine.  
 72.....Spirit of ether.  
 90.....Ether.

#### Dosage.

Gaubius' table of proportion of *dose according to age* has been variously determined. Young's rule is, for children under 12, add 12 to the age and divide the age by the amount thus obtained; thus the dose for 8 years is 8 divided by 8 plus 12=2.5 of the adult dose.

The table of Gaubius is as follows:

For an adult, suppose the dose to be.....1.00 or 60 grains  
 Under 1 year will require dose to be.....1-12 or 5 grains  
 Under 2 years will require dose to be.....1-8 or 8 grains  
 Under 3 years will require dose to be.....1-6 or 10 grains  
 Under 4 years will require dose to be.....1-4 or 15 grains  
 Under 7 years will require dose to be.....1-3 or 20 grains  
 Under 14 years will require dose to be.....1-2 or 30 grains  
 Under 20 years will require dose to be.....2-3 or 40 grains  
 21 to 60, the full dose, or ..... 1 or 60 grains

Age, on the other hand, affects but slightly the susceptibility of the tissues of the eye to the usual agents employed in ocular therapeutics.

#### The Ophthalmologist and the General Practitioner.

There are few general diseases that do not, sooner or later, affect part of the visual apparatus, or that do not cause ocular symptoms. On the other hand, many abnormal states of the eye (ocular strain for instance) induce pathological states in other parts of the body. Inasmuch as *the eye contains examples of almost all of the tissues found in the body alterations in these may present themselves as part of a general process.* In other words, the morbid histology of the eye is not altogether a study apart, but is chiefly an application of the principles proper to general pathology. It is the purpose of

this work to emphasize these truths and to insist that the neglect of the ophthalmologist to study other branches of medicine is as much to be deplored as the failure by the general practitioner to recognize the ocular evidences of disease. While ophthalmologists have their failings, it may be asked, on the other hand, how many medical men intelligently employ the ophthalmoscope in the various forms of the so-called Bright's disease or in suspected brain tumor? How many make use of the perimeter, how many even determine the visual powers of the patient with test types? How many learn the lessons taught by simple inspection of the eye? It cannot be too much or too often insisted upon that these means of arriving at a diagnosis are *not* the special property of the ophthalmologist; *they belong to the student of medicine in exactly the same sense and for the same reasons that does the stethoscope, the sphygmograph, or the hemometer.*

A number of autotoxic, scrofulous, syphilitic, tubercular, rheumatic and gonorrheal affections of the eye are, with their treatment, considered in these pages. We have also noticed *the ocular signs* of several other constitutional diseases that we believe ought to be particularly studied by every practitioner of medicine.

#### **Prophylaxis.**

With reference to the space given to prophylactic therapy in this volume, it has seemed to me that the prevention of disease is a subject so closely allied to its treatment and is so distinctly in harmony with the spirit of modern medicine that to pass it over was to ignore a fundamental principle of our craft. For similar reasons no student of ocular therapy who wishes to be a "well rounded" ophthalmologist can afford to pass over the other chapters of this System written by colleagues so well equipped for the purpose. Surely we have no ambition to be merely "oculists," but physicians and surgeons to whom the eye and its diseases are of particular interest.

#### **Therapeutic Idioms.**

In the embarrassment of riches that this and other works on the subject offer us in combating disease, I am acquainted with no better directions than the following excerpts by Sollmann\* from the treatise of Dujardin-Beaumetz. They are as *a propos* to-day as they were thirty years ago and ought to be well pondered by every thoughtful student of medicine. "Beware," says he, "especially of skepticism. A physician who lacks faith in medicine has no more reason for existence than a priest who does not believe the religion he teaches, or a soldier who is destitute of love for his country and his flag. It is repugnant

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\**Journal American Medical Association*, August 1, 1908.

to reason and to conscience that he can be a good physician who judges of no utility all the remedial agents that have the sanction of tradition and custom. . . .

"Believe, then, in your art, but that this belief may be judicious, reasonable, let it not suffer you to be too easily carried away by what you may deem results of your medication; in therapeutics, illusions are indeed very frequent. This arises from numerous causes, especially from the propensity of the human mind to attribute all that eventuates favorably in the course of the disease to the medicine given, when very often it is only the natural evolution of the disease which the physician has observed.

"This explains to you why it has happened that certain remedies, exhibited with success in some epidemic and contagious diseases, in other seasons have failed to give as good results. This is an example of those therapeutic illusions which have cumbered the materia medica with so many drugs that have obtained a certain brief reputation in their day, soon to fall into forgetfulness and neglect, until another experimenter repeating the trials of a bygone time, restores them to passing notoriety.

"This celebrity, then, this decadence of remedial agents, are unfortunately facts of too great frequency in therapeutics. So after having pruned away all the useless and superfluous substances of the materia medica, if you retain only those which medical practice has consecrated by long usage, you will find that the really useful medicaments are much less numerous than one would suppose, and your daily practice will include but a few drugs. . . .

"Do not employ too many remedies at the same time; do not in your busy endeavors to serve your patient, inflict on him medicines and medications widely differing in their action. Study with care the disease which is before you; go back to the origin of the morbid affection; formulate the leading indications resulting therefrom; decide concerning the diatheses which have influenced the course of the malady, institute a plan of treatment and endeavor to carry it out with a very moderate exhibition of drugs. . . .

"This is not all; it is desirable that the physician should use the utmost care in prescribing his medicines. The hospital practice does not, unfortunately, favor this special study; we find ourselves in a particular situation which obliges us to formulate too rapidly and incompletely, so that after having followed for several years our hospital services, the most of you are entirely ignorant of the art of prescribing.

"This ignorance has more serious consequences than you think



of, and if we see, in our day, the pharmaceutical specialties having a constantly increasing importance, it is in some measure due to the fact that physicians do not acquire that expertness in the preparation of their medicines which they ought to possess, and prefer lazily to rely on the combinations of the manufacturing chemist, trade-mark preparations, or even the nostrums of the charlatan.

"But, if by pursuing this course, the practitioner often promotes the fortune of the pharmacist, he despoils himself in the end, for the patron, beguiled by the advertisements which accompany his nostrum, is almost certain to apply in the future, not to the physician, but to the vendor of the trumpeted drug.

"Learn, then, skilfully to prescribe, and not only to write in an orderly and judicious manner the substances which compose your prescription, but also to render the combination as pleasant to the taste as possible. Repudiate, therefore, in a general way, all the specialties which inundate the therapeutics of to-day. Exercise the greatest care in the directions which you give to the patient or his nurses; do not fear to enter into the minutest details; indicate how the external applications should be made, and the times for giving the internal remedies; regulate carefully the little incidents of the day, and be particular about the diet. For you must ever remember that pharmaceutical measures go but a little ways in the care of your patient and that you can often accomplish more by hygiene than you can accomplish by medicine."

#### **Diagnosis Before Therapy.**

Finally, one cannot insist too frequently or too urgently upon the necessity of determining the exact nature of the disease before considering or applying the remedy. This injunction may sound commonplace enough and yet how often, in the hurry of practice is it forgotten! How frequently are we tempted to treat *as such* a "chronic conjunctivitis" or a "chronic catarrh of the lids" instead of first remembering that, among other possibilities, the eyes before us may really be suffering from a disease of a neighboring cavity, a long-standing Morax-Axenfeld infection (to be cured by a zinc sulphate or zinc chloride collyrium), or that a year-long hyperemia of the palpebral conjunctiva is loudly calling for a mild boric acid eyewater, cold fomentations and the correction of a compound hyperopic astigmatism? We are frequently obliged to speak of a "chronic choroiditis," an "optic papillitis," or a "subacute iritis," but in considering the therapy of these alterations of tissue one should keep one's mental gaze firmly fixed on the etiological factors in the case. After all, *the diagnosis is the thing!*

# CHAPTER II.

## A HISTORY OF OPHTHALMIC THERAPEUTICS.

BY ALFRED MURRAY, M. D., CHICAGO.

*Beginnings of Ocular Therapy—Substances Used—Inscriptions on Tablets—New Ideas—Belladonna—Spectacles—Oculist's Seals or Stamps—Sixteenth Century Therapeutics—Practices and Superstitions—Hygienic Rules—Mineral Substances—Setons—Head Washes—Curious Prescriptions—Treatment of Squint—Purgings—Artificial Eyes—Electricity—Cocain.*

The history of ophthalmic therapeutics, at least insofar as it is known to the present generation, dates back to 1500 years B. C., or a thousand years before the time of Hippocrates. For our information regarding this early period we are chiefly indebted to the papyrus Ebers, or, rather, to a translation of this sealed book of the Egyptians published in 1875.

It is interesting to note that many of the drugs familiar to us in the present day were in vogue many centuries ago—especially mineral substances such as soda, red oxide of lead, verdigris, antimony and saltpetre. Other ingredients of the remedies of this period were myrrh, frankincense, fennel, alcohol, powdered wood, worm borings from trees, onions and many others of like character.

Most interesting of all, however, are the excipients in which these drugs and substances were prepared. For instance, *honey* seems to have been a particularly favorite vehicle in any number of the remedies. "Milk of a woman who has borne a male child" was also much used, and in a few instances curdled milk seems to have been highly valued. The blood of various animals, such as the ox, ass, swine, greyhound and deer, also of the bat, lizard, etc., was supposed to possess much virtue in certain conditions. And last, but not least interesting, was the widespread use of the dung of various birds and animals, as well as the urine of the human animal. For instance, one prescription calls for "the urine of an innocent boy, cooked in a brass vessel with honey."

The use of such remedies seems to have prevailed not only during the time of Hippocrates and the age preceding him, but for hundreds of years thereafter their popularity apparently endured and even increased, for in the books of the sixteenth century they form the in-



gredients of innumerable prescriptions. Indeed some of them are applied in some of the countries of Europe even at the present day.

A few of the more interesting prescriptions used during this period will not be amiss. For instance, in the treatment of trachoma such a combination as the following was recommended: Verdigris, myrrh, onions, gazelle dung, oil. This mixture was to be painted on the lids with the feather of a vulture! Corneal scars were treated with the brain of a turtle mixed with honey and painted upon the lids. For corneal opacities in general a combination of baby excrement, honey and fresh milk was considered excellent. For strabismus, resin of acacia mixed with powdered onions and the brain of a turtle was considered quite effective. For "poor and dim vision" a combination such as the following was injected into the ear of the patient in order that he "might be well on the spot": Water from a pig's eye, antimony, red oxide of lead, honey.

A custom in vogue as early as 330 years B. C. was the preparation of little, usually quadrant, tablets, bearing inscriptions which usually included the name of the oculist, the chief ingredient of the remedy and the name of the disease in which it was especially indicated. This custom prevailed for hundreds of years, while pictures of such tablets appear in ophthalmic treatises of a few centuries ago. They were, of course, wholly or partially dissolved in water, when it was desired to use them.

Some of the remedies, such as antimony, soda, powdered wood, etc., were to be used only during certain periods or seasons of the year, as, for instance, from "January 17th to February 14th" or some similar time, although antimony in the form of a salve might be used all the year round. This salve of antimony was prepared by rubbing the metal with goose fat in the early morning, and it was to be applied to the eye at night.

Another general remedy for the eye was a human brain divided into equal halves, one half to be mixed with honey and the eye rubbed with it in the evening, and the other half to be dried, rubbed up fine and applied to the eye in the morning.

During the time of Hippocrates and Galen (A. D. 130), these Fathers in Medicine established many new ideas in the treatment of eye affections. The names of many additional drugs and substances now appear, although the methods of treatment were not unlike those which prevailed during the pre-Hippocratic period. "*Augenschminke*" or rouge (particularly popular at this time) enjoyed a reputation for 4,000 years not only for making the eyes more beautiful, but of assisting in the preservation of sight as well. The antimony from which it was made was a very expensive substance. Other drugs, which

began to make their appearance in the prescriptions of these days were copper, saffron, zinc, iron oxide and lapis lazuli.

The age of Galen saw the introduction of various antiphlogistic methods, such as hot and cold fomentations, and the infusions of various plants; also of gums of such fruits as the cherry and plum. The gall of various animals—the lion, hyena, crocodile and lizard also came into more general use.

For their analgesic effect such drugs as opium, belladonna, and hyoscyamus were also used; and for their irritant effect such substances as aloe, crocus, mustard and pepper. The employment of milk, urine, feces and sputum, both of the lower animals and of man, for the purpose of stimulating vision, still prevailed.

Regarding *belladonna*, Fukala, of Vienna, in a *History of Belladonna and Mydriatics*, states that this drug was first mentioned between the time of Hippocrates, 500 B. C., and Galen, 130 A. D., although Hippocrates himself made no mention of it as an eye remedy. On account of the unfavorable opinion of Galen regarding this drug it was abandoned as an eye remedy for centuries. Galen was alarmed by the blurred vision and paralysis of accommodation occasioned by it, and thought healing could be accomplished equally well through the use of hot fomentations, blood-letting and catharsis.

The Arabian oculists reintroduced belladonna into ocular therapeutics despite the prevailing opinion established by Galen, but for nearly a thousand years it was not generally prescribed—that is, until almost the close of the eighteenth century. The name belladonna (“beautiful woman”) was not given it until the middle of the sixteenth century. The first really accurate description of its effect on the eye was furnished by Münch toward the end of the eighteenth century.

With reference to *blood-letting*, it is interesting to know that leeches were used during this period.

From the time of Galen to the beginning of the sixteenth century no noteworthy advances were made in the treatment of eye affections except the introduction of spectacles at the close of the thirteenth century, although there is in existence a lens which can be almost certainly traced to the seventh century B. C. It is also a fact of history that Nero was myopic and used an emerald through which he watched the sports in the arena. The first spectacles proper made their appearance in Florence about 1280 A. D.

The Greeks copied their methods mostly from the Egyptians, and the Arabians, in turn, copied theirs from the Greeks, but recognizing the value of surgical interference in the treatment of eye affections,

the use of the various remedies with the Arabian surgeons played only a minor part. On the other hand, while those scientifically inclined resorted to operative treatment, many adhered to the old methods, this being particularly true of women doctors of that day and it is said their ignorant and antiquated practices resulted in irreparable damage to many eyes. In some parts of Arabia these female practitioners are said to be still locally celebrated.

The stamps or seals of the oculists just referred to were also used by the Arabs. Various eye waters, or collyria were known to them as *white collyria*, *green collyria*, *mild-red* or *sharp-red collyria*, according to their action or color. They were prepared in the form of balls or sticks to be dissolved for use *pro re nata*.

*White of egg* seems to have enjoyed great popularity in the treatment of many affections. It was sometimes freshly beaten and combined with oil of roses for the purpose of moistening the bandage following cataract operations. Quicksilver was used to kill lid lice "by virtue of its smell." Hemorrhage was controlled by instilling into the eye a combination of salt and caraway which was chewed and then strained through cloth. The Greeks also often chewed their eye remedies.

Probably the most interesting period in the history of eye therapeutics is the sixteenth century, and since the therapeutic methods which prevailed almost universally during this period are fully represented by those which were at that time used in Germany, an enumeration of the chief drugs, substances, appliances and methods of treatment described in the work of Georg Bartisch, published in Dresden in 1583, will serve as a generalization. Superstition, witchcraft and similar factors such as the influence of the various humors of the body played a very important part in the therapy of disease not only in the sixteenth century and the centuries preceding it, but during the two centuries that followed. Indeed, the influence of the humoral pathology and other medical superstitions has not, even in our day, entirely faded.

The following are a few of the more popular remedies: It was supposed that rubbing the eye with amber, gold, pearls, coral, etc., was of benefit, while it was still believed that to obtain full benefit therefrom foods, baths, cupping and various methods of treatment must be used in their proper season.

The *influence of colors* upon the eye was considered of great importance; for instance, blue was supposed to be especially refreshing to the eye, and red very irritating. Violets and similar flowers

were therefore chosen for collyria and unguents. Other plants were selected because of their names, such as, for example, "eyebright."

In every treatment of diseases of the eye the religious aspect was considered; great stress was laid upon the influence of the Almighty, and in acknowledging the cure of any affection equal credit was given to Him and to the oculist. Medicines were not supposed to have much effect without the help of God.

Various drugs were to be taken only when the moon was waxing or waning, and certain treatments given only in accordance with signs of the zodiac. The eye should not be touched with instruments during the waxing of the moon. Regarding eye-drops, no woman should either make them or put them into the eye. Particularly during her periods was she likely to ruin anyone's eyes by looking at them or putting anything in them. A male oculist should always introduce the drops.

Looking at various precious stones such as blue sapphire, pearls, turquoise, etc., was thought to improve the vision and relieve the patient of the necessity of wearing glasses. These stones were often worn in rings for this purpose, and the patient instructed to look at them frequently. Pater Nosters made to represent watches, books, hearts, cushions, etc., set with precious stones, and containing powders, roots, herbs, and what not, were worn about the neck against the bare skin.

The idea of the humoral origin of diseases, that is the mixing together, lack of, or abnormal increase in quantity of the various humors, choleric, melancholic and otherwise, was very popular, particularly when the disease could not be accounted for in any other way. (Not unlike the "idiopathic" idea of diseases to-day.) Therefore, more attention was paid to the general condition of the body than was the case in former centuries. It was thought that a regular, properly ordered life, with strict diet, and even such minor considerations as care of the mouth, would cure many eye affections, and such general rules and treatment were doubtless often of more benefit and worked more cures than the atrocious substances which were used for local application. Perhaps some of us might take this hint in our modern therapy!

Some of these rules of living were excellent. There were various bodily restrictions and rules of hygiene. Particularly to be avoided were over-exertion, exposure to draughts, staying out all night, emotions and excesses. Sharp odors and vapors should be avoided. Particular stress was laid upon bad breath, specifically that from

onions, garlic, radishes, unripe cheese, and cabbage. The odor of this latter substance was supposed to be especially injurious to the eyes.

Blood-letting, purging and water drinking formed a part of nearly every treatment, no matter what the condition, whether ingrowing cilia, cataract or "cross" eyes.

In view of the supposed humoral origin of various diseases of the eye such substances as juniper berries, pepper and ginger were chewed in order to increase the flow of saliva. Sneezing was also encouraged for the purpose of increasing the flow of fluid from the nose. This consequent depletion of the head, as it was called, was especially recommended where the humors were present in too great quantity. On the other hand, sneezing was to be avoided as much as possible where the humors were too scanty. Care of the hair was also emphasized. Combing it from the forehead backward was of particular value. Various powders were strewn upon the head, and fats and waters rubbed in. The ears were cleansed and oils applied to them.

Regarding *mineral substances in use during the sixteenth century*, these do not differ materially from those which had been previously employed for centuries. They were, however, still used in the crude form, as chemistry had not yet reached that stage of development which made it possible to isolate the active principles of drugs. Roots, herbs, and leaves formed the chief ingredients of most prescriptions.

Sugar seems to have enjoyed considerable popularity both in solution and as a powder. Honey, white of egg, and cheese served as excipients and bases, fat being seldom used for the latter purpose. Spices were also much used for their stimulating properties, while balsams and resins, frankincense and myrrh, served therapeutic purposes. Opium was used for its sedative effect; and turpentine, cantharides, etc., as irritants. Decoctions of lentils were supposed to act favorably upon the lens, and lentil porridge and baked apples were used as fomentations.

Of the more curious remedies might be mentioned saliva, breast milk, powdered grasshoppers, while old beer and wine were employed as vehicles, as well as butter and lard. Blood taken from under the wings of swallows and doves and various birds was supposed to act favorably in certain diseases of the eye because of the excellent vision which these birds possessed. The blood of a young dog, still sucking, together with the heart and liver of a badger, was recommended as well.

Burnt alum, calcinated pearls and coral, and powdered precious stones, had their uses. The "Siefs" of the ancients were frequently

prescribed. These were prescriptions containing not only the various ingredients already mentioned, but many mineral substances besides.

One section in the treatise of Bartisch lays particular stress upon the too prolonged use of irritating drops in inflamed eyes, and suggests the substitution of milder remedies.

Of local measures *setons* were applied in all sorts of conditions, and usually to the neck. They had very elaborate instruments for their introduction. The custom of piercing the ears in various eye conditions probably had its origin in this way. Counter-irritation with plasters, the active ingredient of which was cantharides, was applied to the neck and to the back of the ears for any number of conditions, even for the cure of strabismus.

Head washes were very popular and it was essential that they be allowed to dry of their own accord. The ingredients were prescribed as "so many handfuls of this and that ingredient." To introduce drops the patient was obliged to lie quite flat on a bench (that the drops might not run out) when the eyewater was introduced by means of a sponge. The patient was then directed to remain in the recumbent position for a quarter of an hour.

Innumerable prescriptions and treatments were employed during the 16th century which appeal to us as being so odd and, in some instances, so ridiculous, that the mention of a few of the most interesting cannot be refrained from. Some of the prescriptions are not unlike the contents of the witches' caldron described in Macbeth. For the removal of a foreign body "take wine or water into the mouth and spurt it into the eye until the foreign body comes out;" or "put blue sapphire stone into the conjunctival sac for awhile." Various other stones were also used in this way, and the custom of introducing the so-called "*Krebsauge*" still retains its popularity in some of the provinces of Germany.

A remarkable cure for squint is as follows: A cap of linen or satin designed to envelop the whole head, with the exception of the ears, nose and mouth, was applied and fastened behind with little strings. In cases of *convergent squint* holes were cut in the cap far out to the temporal side so that the patient would be obliged to turn his eyes outward in order to see straight ahead. For the purpose of increasing the effect of this contrivance small funnels of lead were applied over these openings, giving a very curious appearance to the wearer. For the cure of *divergent squint* the holes were cut nearer the nose, or else a little wooden, box-like affair, with a vertical, slit-like opening in the center, was applied to the median line of the mask so that the patient would be obliged to turn his eyes in, in order to see.



These devices were worn until, "with the help of God," the squint was cured.

For discoloration of the conjunctiva an eye water was made of the following ingredients: Orange skins, lemon skins, white beans, white root, melon seeds, *fœnum græcum* (a plant), olibanum, and camphor. They were all made into a powder, and half a pint of the milk of a woman nursing a little girl, with an equal quantity of white chicory water was poured over it. This was to be dropped into the eyes "when they become beautiful and clear."

For those who could not see after the sun was up the following prescription was given: Three plucked swallows, green young corn, fennel weed, white hen-excrement, blue chicory root, yellow amber, musk. The green ingredients were to be pounded up, and the dry ones pulverized, all mixed together and Mayflower water poured over them. This concoction was allowed to stand three days and then distilled, but under no circumstances, strange to say, was it to be taken internally.

*Purging* four times a year cleansed the head of injurious humors and thus improved the vision. It also relieved one of the necessity of wearing glasses if one wished to lay them aside. Pills for purging must be taken during the waning of the moon, and not when it was waxing, otherwise they did not have the proper effect.

In addition to the ordinary remedies already mentioned, *cataract* was treated by other means peculiar to itself. For instance verbena worn about the neck against the bare skin was considered very effective. The men wore blue verbena in conditions of white and gray cataract, and women wore the yellow variety for green and yellow cataract. Different kinds of cataract required different kinds of waters for moistening the compresses. The latter consisted of little pledgets of cloth or tufts of flax.

A remedy for red and brown warts about the eye was a combination of honey, sheep dung, goat dung, and vinegar. Proud flesh was cured with crumbs of warm bread, salted. For pain, pigeon picked perfectly clean, rain worms, camphor, and various herbs, with night shade water for a vehicle was applied on cloths, or, cremate an unborn stork, make the foetal unfortunate into a plaster with white of egg, put the mixture on cloths, and apply to the eye.

One really valuable addition to ocular therapeutics during the sixteenth century, at least from the standpoint of a cosmetic effect, was the introduction of artificial eyes by Ambroise Paré (1510-1590). The original eyes were of gold and silver covered with enamel. The "virgula" of Paré had attached to it a spring which went half way

around the head in order to hold the eye in place. Glass eyes were first made in Venice in the beginning of the seventeenth century when the glass industry was at its zenith; they were almost identical with those in vogue at the present time.

Following the period just described, the methods of treatment and most of the drugs then employed continued to enjoy popularity for a century or two, so that it was not until the nineteenth century that the treatment of eye affections began to be more rational. With the advances in the science of chemistry (at the beginning of the eighteenth century) there began to be isolated the active principles of various drugs which had formerly been employed only in their crude state. These soon superseded the use of roots, herbs, etc.

The introduction of electricity in the second half of the eighteenth century gave rise to the idea that practically all eye affections could be cured by this means, and it consequently enjoyed great popularity for many years. In the early part of the nineteenth century the active principle of belladonna was isolated and called atropia. About this time, also, strychnia was used subcutaneously in the treatment of eye affections.

Outside of these discoveries no great progress was made in the matter of ocular therapeutics until the time of von Graefe who, with others, did inestimable service to the whole world by inculcating the scientific employment of remedies. The revival of the use of silver nitrate, for example, which had been discarded for at least a century, was due to him.

The latter part of the nineteenth century marked the appearance of many new drugs and the improvement of old ones. Protargol first appeared in Germany in 1892, and various mercurial salts were prepared in the form of special salves. Of the innumerable drugs which have taken a place in the therapeutics of eye affections may be mentioned adrenalin, dionin, eupthalmin, holocain, and an endless list of remedies some of which have proven of value; others have proved to be passing fads.

It is interesting to note that the first subconjunctival injection was performed in 1866 by Rothmund, a solution of corrosive sublimate being used. Calabar bean extract was first called eserine in 1863, and its influence in reducing the tension of the eyeball recognized by Laqueur in 1876. About this time pilocarpin also came into use for a like purpose.

Coming to our day and generation it might be said, in closing this short account of ocular therapy, that one of the most important advances in ocular therapeutics for centuries was the discovery of the anesthetic effect of cocaine upon the eye. Although the local anes-



thetic effect of this drug upon the mucous membrane of the mouth and nose was known many years before, it remained for Carl Koller, of Vienna (now of New York City), in 1884, to recommend its use in operations upon the eye. This was without doubt one of the greatest boons to humanity since the discovery of the anesthetic effect of chloroform, and rendered possible most of the operative interference about the eye without the use of general narcosis.

Boric acid, one of the most popular drugs for use about the eye, both by the profession and by the laity as well, was discovered in the beginning of the eighteenth century, although the crude substance borax occasionally appears in prescriptions of the sixteenth century. It first came into the enjoyment of its greatest popularity at the time when Lister revolutionized surgery by his application of antiseptics and asepsis to wounds, and it still remains one of our most valuable remedies.

# CHAPTER III.

## CLASSIFICATION OF OCULAR REMEDIES.

*Alkaloids—Local Anesthetics—Analgesics—Infiltration Anesthesia—Antiseptics—Astringents — Blisters — Cauterants — Cerates—Collyria—Compresses — Counterirritants — Cycloplegics — Disinfectants — Emollients—Emulsions — Electricity — Escharotics — Evaporating Lotions — Glycerites — Hemostatics — Irrigating Fluids — Juices — Lymphagogues—Medicated Waters.*

Owing to the enormous increase during the past few years in the number of ocular remedies and the variety of uses to which many of them are put it is impossible to classify them under the old, familiar headings. Yet, as the literature of ophthalmology as well as the pages of therapeutic manuals continue to speak of "astringents," "antiseptics," "cauterants," etc., as if they indicated members of well-defined classes of remedies and inasmuch as it is often convenient to refer to them as such, I propose to say a few words about Cycloplegics, Mydriatics, Miotics, Astringents, Antiseptics, Counterirritants, Analgesics, Local Anesthetics, etc., in alphabetical order. All these remedies are in addition treated seriatim, in their proper place, under individual headings.

The form in which these remedies are employed is also of some considerable importance and references to these are to be found in this chapter.

### **Alkaloids Employed in Ophthalmic Practice.**

In this connection one should consider the value of *oil* (q. v.) (olive, castor, almond) *as a menstruum for poisonous alkaloids*. The advantages are numerous especially when a long-continued course of treatment is probable. The oil does not as readily as water run into the nose by way of the nasal duct, and so produce disagreeable symptoms, while its absorption takes place slowly and its effects are continuous and are not dissipated before the next instillation, as may be the case with aqueous solutions.

For similar reasons *ointments* are also indicated where a mild, uninterrupted and continuous effect is the purpose of the medication. I have used these oleaginous solutions and mixtures for several years in

lieu of watery solutions and have reason to recommend them to those of my confreres who have not tried them.

#### **Analgesics or Anodynes, Ophthalmic.**

Agents that applied to the part affected or taken internally relieve pain.

The most important for the ophthalmologist are alypin, atropine and most of the cycloplegics, chloretone, cocaine, codeine, conium, dionin, eucaine, gelsemium, hypnol, lupulus, opium preparations, orthoform, phenacetine, phenazone and stovaine, *Arlt's salve*, *cherry laurel water*, *brenzcain*, *chloral hydrocyanate*, *chloral hydrate*, *euphorin*, *veratrine*, as well as most of the other local anesthetics.

#### **Anesthetics, Local.**

An incomplete list of these includes *acoin*, *alypin*, *anesin*, *brenzcain*, *cocaethyline*, *cocaine*, *ecgonine* and its other salts, *erythrophleine*, *eucaine with its salts Alpha-eucaine and Beta-eucaine*, the latter being more effective, *Beta-eucaine lactate*, *helleboreine*, *holocaine*, *homocaine*, *nirvanin*, *novocaine*, *stovaine*, *tropacocaine*, *yohimbin*, *orthoform*, *subcutin*, *anesthesin*, and *strophanthin*.

Reichmuth (*Zeitschr. für Augenheilkunde*, September, 1906) has investigated most of the local anesthetics and concludes that *cocaine is the least harmful of them all*. Dropped on to the cornea they produce similar appearances—all more intense than cocaine. Tropacocaine resembles cocaine most in this respect; cocaine alone constricts the blood vessels, all the others dilate them. For *subconjunctival injections and washing out the anterior chamber*, cocaine does least damage to the *epithelium and tissues*, while acoin and holocain in the rabbit produces severe inflammatory and necrotic processes, from which the eye is sometimes lost.

Darier (*Thérapeutique Oculaire*, p. 90) employs in every case where an anesthesia of short duration is required *alypin or stovaine* (q. v.). Indeed, he believes these anesthetics to have identical therapeutic powers. If he desires *anesthesia by infiltration* he combines one of these agents, or both of them in equal doses with cocaine. He also prefers cocaine in cataract extraction, and, on the whole feels sure that when cocaine is employed with proper knowledge of its advantages and disadvantages it is the best local anesthetic for surgical purposes.

Before the discovery of stovaine and alypin as local anesthetics, Schmidt\* arranged the principal *local anesthetics in order of merit* from the following points of view: First, rapidity of anesthetic action.

\**Deutsche Medizin. Zeitung*, 1899.

Of these he places first in order tropacocaine, then holocaine, then cocaine, then eucaine A., then eucaine B., and finally orthoform. Second, duration of the anesthesia:—orthoform, cocaine, eucaine B., eucaine A., holocaine, tropacocaine. Third, intensity of the anesthesia:—cocaine, tropacocaine, eucaine B., eucaine A., orthoform. Fourth, analgesia when the eye is inflamed:—cocaine, tropacocaine, eucaine B., eucaine A., orthoform. Fifth, mydriatic action:—cocaine tropacocaine, eucaine A., eucaine B., holocaine. Sixth, blanching of the conjunctiva:—cocaine, tropacocaine, eucaine A., eucaine B., holocaine. Seventh, scleral congestion:—eucaine A., eucaine B., tropacocaine, holocaine. Eighth, amount of local irritation:—orthoform, eucaine A. and B., cocaine, tropacocaine. Ninth, antiseptic properties:—Orthoform, holocaine, eucaine B., tropacocaine, cocaine. Tenth, poisonous qualities:—holocaine, cocaine, eucaine A., tropacocaine, orthoform.

As intradermic, subcutaneous or subconjunctival injections, Darier uses a weak (one per cent. solution) of cocaine with or without acoin. The latter agent being non-toxic he has found this combination very effective and has never seen any complications from its use.

G. E. de Schweinitz refers to ocular anesthetics as follows:

"The ocular anesthetics with which one is best acquainted are cocain, holocain and eucain. *Cocain* is very advantageous for temporary anesthesia, but not good for continuous use, as it is apt to produce drying and wrinkling of the corneal epithelium, and, if anything, tends to increase the corneal ulceration if it is too constantly used. *Holocain* is an admirable anesthetic in a 1 per cent. solution. It causes anesthesia in from fifteen seconds to one minute, and maintains this anesthesia for about ten to fifteen minutes. Its instillation is followed by a temporary burning sensation. It differs from cocain inasmuch as it does not enlarge the pupil, increase intraocular tension, and is distinctly bactericidal. Its direct application to corneal ulcers has often in my hands proved most beneficial. I frequently add it to the various antiseptic collyria—for example, boric acid lotion—and sometimes apply it directly, by means of a cotton mop, to the ulcerated surface, and have never had occasion to regret a practice of this character."

Although numerous local anesthetics, especially eucaine (q. v.) and holocaine (q. v.), have been advised as substitutes for cocaine it is still the favorite agent in operative procedures. I prefer (as giving the maximum anesthesia with the least cocain) for the average ophthalmic operation the following formula:

R

Cocain. hydrochlor.	gr. xx.
Holocain. hydrochlor.	gr. v.

Aquæ dest. et steril.

5j.

Instil one drop every three minutes for 12 minutes.

Although several observers believe that the anesthetic action of solutions of cocain, both of the alkaloid and of the salts, is lessened or destroyed by boiling, this view is not held by C. R. Holmes who always sterilizes his solutions in this way, and has used it for operations upon the eye, ear and nose thousands of times. In his experience it is the rarest thing to find that the drug is not efficacious, and in these rare cases he has attributed its lack of action to the idiosyncrasy of the patient.

The combination of cocaine, eucaine and other anesthetics with adrenaline, suprarenine and other hemostatics to obtain the local effects of both without the inconvenience, especially during operations on the eye, of instilling these agents separately, is not to be forgotten. To supply the demand for them a number of compounds have been marketed by various chemists, although it seems hardly worth while to have dignified them with trade names. It may be observed, in passing, that Darier (*Thérapeutique Oculaire*) set the example by giving the name *cocarenaline* (q. v.) to a mixture of cocaine and adrenaline and a very effective compound it is, *anesthetizing and blanching the conjunctiva* and other ocular tissues, thus clearing and keeping clear the field of operation.

Verderame\* found that the rabbit's cornea was decidedly affected by 2 to 10 per cent. solutions of *novocain* (q. v.). Not only did the anterior epithelium become irregular but there were distinct erosions with marked loss of corneal substance. He found the injury to the cornea to be greater than with the use of cocain and believes its anesthetic effect to be less.

I. Frank speaks favorably of his experience of alypin. He finds it in 4 per cent. solution, free of many of the drawbacks one experiences in the use of cocain; it does not dry the cornea, there is no mydriasis and no impairment of accommodation.

Sidney Stephenson makes the following emphatic statement regarding alypin: That he had never seen a bad result from 2 per cent. alypin, despite the fact that from 1905 to August, 1908, it had displaced all other local anesthetics in his practice.

*Subcutin* is an ethyl ester of para-amidobenzoic acid and occurs as a white crystalline powder soluble in 100 parts of cold and 40 parts of hot water. As a *local anesthetic* it is employed—generally in hypo-

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\**Zeitschrift f. Augenheilkunde*, Sept., 1907.

dermic form—in twelve and a half per cent. strength, dissolved in physiological salt solution. (See, also, *Anesthesia*.)

*Anesthesin* is a white, odorless, tasteless powder, very slightly soluble in water but easily dissolved by alcohol and olive oil. As a *local anesthetic* it is valuable and employed as an ointment and in 10 per cent. strength is used as a *dusting powder*. In a limited way it is employed hypodermically in minor ophthalmic surgery.

Snellen (Graefe-Saemisch *Handbuch*) regards the following *substitutes for cocain* as comparatively useless in practice, owing to defects in their action: *Arecoline* (q. v.), *carpeine*, *convallarine*, *drunine*, *erythrophleine* (q. v.), *haya poison*, *helleborein* (q. v.), *stenocarpin* and *strophanthin*. The majority are mostly the restilts of laboratory experimentation and are either very irritating to the ocular structures or their anesthetic action is not as lasting or as prompt as that of the cocaine salts. On the other hand, he puts forward the following claims of *eucaine* (q. v.): It is 4 to 5 times less poisonous than cocaine; it is not decomposed by boiling; the solutions remain fresh and active for months; it is slightly germicide; it produces neither accommodative paresis nor mydriasis; it is cheaper than cocaine.

Bruns and Robin\* (*Annals of Ophthalmology*, October, 1906), employ a mixture containing 10 drops each of a 4 per cent. solution of cocaine and of adrenaline chloride (1:1000), and 20 drops of normal saline solution for inducing anesthesia in painful operations, especially excision of the eyeball. Each 40 drops of the mixture therefore contains 2.5 grain of cocaine. *Ten drops of the mixture are injected deeply, behind the equator of the eyeball, along each rectus muscle.* An interval of five minutes is then allowed to elapse before the operation is commenced. The method, however, is not entirely devoid of pain. Three of Bruns and Robin's patients only evinced no evidence of suffering throughout the entire operation. Those who complained of pain referred it to the last stage of the *enucleation*—that is to say, the division of the optic and ciliary nerves. The authors noticed that robust and full-blooded men appeared to suffer more than the frail and delicate. According to Bruns and Robin, the advantages of local over general anesthesia are:—the consciousness of the patient, thereby affording a safeguard against removing the wrong eye; the safety to life; and, finally, the fact that most of patients seem to prefer local anesthesia.

#### **Anesthesia, Infiltration.**

##### *Schleich's local anesthesia method.*

As is well known this form of local anesthesia was introduced by

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\*Sydney Stevenson's review in the *Ophthalmoscope*, Mar., 1907.

Schleich (q. v.) and consisted *not* of the *subcutaneous*, but of the *intra-cutaneous* injection of solutions containing cocaine. It was later discovered that it is the pressure upon the dermal nerve endings rather than the numbing effect of the cocaine that bring about the local anesthesia and that normal or other weak salt solutions have much the same effect. Stutzer\* recently, and many others prior to him, have successfully employed this method in operations about the eye, especially of the lids where it is, if at all, specially of use. To the cocain and salt solution of Schleich he adds a small quantity of adrenaline. He employs the method in enucleation only if there is no pain or marked congestion of the vessels. For removal of the lachrymal sac he injects the region of the infratrochlear; for operations on the lids the points of exit of the infra-, supra-orbital or frontal nerves.

The psychic effect on the patient of having painless injections made into an otherwise sensitive region seems to allay the nervous dread of an operation, a more important factor than we, who are accustomed to witness suffering, generally realize.

In the employment of Schleich's *infiltration-anesthesia method* it is convenient to have a properly prepared, fresh, sterile solution at hand for *intra-dermal injection*. This need is met by the use of *tablets* each of which is to be dissolved in 100 cc. of sterilized water, thus making the necessary infiltration fluid ready for the syringe. As prepared for the market these tablets can be had in *three strengths*, as follows:

	I.	2.	3.
	Strong	Normal	Weak
Cocaine hydrochlor. ....	0.20	0.10	0.01
Morphia .....	0.025	0.025	0.005
Sodium chloride .....	0.20	0.20	0.20

*Painful operations under cocaine and morphia anesthesia.*

Although I have not infrequently done very painful operations upon sensitive ocular tissues while the patient was under the influence of *cocaine alone or combined cocaine anesthesia* I cannot say that I recommend the method. Ellis\*\* believes that *enucleation can be easily and very nearly painlessly done under the influence of cocaine* if we have, *first*, an intelligent patient; *second*, a patient who has arrived at years of discretion; *third*, an eye moderately free from intense inflammation. In case the eye is inflamed holocain 1 per cent. may be used, since this drug acts better on inflamed tissue than cocain. General anesthesia, of course, is best in the general run of cases, but if we

\*Zeitschrift f. Augenheilk, June, 1907.

\*\*Author's abstract, Archives of Ophthal., Jan., 1907.



have any one of the three above conditions, local anesthesia can be employed perfectly well, especially since it is unaccompanied by the disagreeable and nauseating effects of ether; and to a patient who has any real or fancied lesion of the heart, lungs or kidneys, it is as a rule greatly to be preferred. The method found to be the best is that of anesthetizing the conjunctiva with a few drops of a four per cent. solution of cocaine. The conjunctiva is then cut close to corneal margin and dissected back until the muscles are reached. Cocaine solution from  $\frac{1}{2}$  to 4 per cent. is then injected along the course of the ocular muscles with a curved hypodermic or lachrymal needle, taking particular care to thoroughly anesthetize the region occupied by the entrance of the optic and long and short posterior ciliary nerves to the globe. The usual method of procedure in any enucleation is then employed. A subcutaneous injection of morphia may be given about fifteen minutes before the operation.

The following mixture, advocated by Terrien is used to inject about the posterior portion of the globe *instead of cocaine alone*:

R

Cocain. hydrochlor.	
Morphiæ. hydrochlor.	ãã 0.01
Stovain.	
Sodii chloridi	ãã 0.02
Aquæ dest.	5.00

One c.c. of this solution may be injected, and the nerve cut with but slight discomfort.

### Antiseptics.

As in general surgery so in ophthalmic therapeutics, we employ those agents that are found by experience to act best as germicides. The delicate structures of the ocular apparatus require, however, the kind of care that is not called for elsewhere, so that it is not always compatible with safety to employ the same anti-bacterial remedies (or at least not in the same dosage) that are indicated in wounds or other lesions of more resisting tissues. For example, mercuric bichloride and carbolic acid are well tried and useful antiseptics, but they cannot be properly used in the conjunctival sac in anything like the strong solutions which one would apply to the tissues of the arm or leg. The desire to kill all the pathogenic bacteria that infest the eye—as in a laboratory experiment—induced early clinicians to use the most powerful and effective germicides, but it was soon demonstrated that it is not only impossible to sterilize completely the conjunctival sac and the surrounding tissues, but that the attempt to do so is likely to bring about vascular disturbances and other changes that are more productive



of harm than the disinfection of the ocular tissues does good. This is especially true of operative procedures; strong antiseptics destroy the vitality of the wound edges, delay healing and actually invite infection.

The importance as well as the difficulties of rendering the conjunctival sac aseptic is illustrated by the calculation of Novy that thirty billions of bacteria contain about 1-400 grain of organic matter, an amount too small to be appreciated by our unaided senses.

As the various antiseptics used in ophthalmic surgery are separately dealt with and their comparative value as microbicides elsewhere discussed, it may be well to furnish a list of the preparations usually included in the category. Among them are *boric acid*, *picric acid*, *airol*, *airoform*, *alphozone*, *amyloform*, *lotio nigra*, *aqua sublimatis*, most of the *silver salts*, *aristol*, *aseptol*, *berberine* and *hydrastine* with their salts, *betanaphthol*, *blenol*, *boro-borax*, *borol*, *boroglycerite*, *oil of cade*, *calomel*, *calomelol*, *cerevisine*, *chloral hydrate*, *chlorine water*, *copper sulphocarbonate*, *creolin*, *euophen*, *formalin*, *gold chloride*, *gujasanol*, *Guthrie's salve*, *hydrastine*, *hydroquinone*, *ichthyol*, *iodine* and its preparations, most of the soluble salts of mercury, the *bichloride*, *benzoate*, *cyanide*, *oleate*, *oxycyanide*, *iodides* and *oxides*, *monochlorophenol*, *phenoalyl*, several *potassium salts*, including the *chlorate* and *chloride*, *protargol*, *pyoktanin*, blue and yellow, *quinine* and its salts, *quinosol*, *radium*, *resorcin*, *salol*, *sodium benzoate*, *benzosulphinate*, *borate*, *chloride*, *saccharate*, *salicylate*, *soziodolate*, *sulphate* and *chlorinated soda*, *sophol*, *soziodole-zinc* and *mercury*, *sublimine*, *thiogenol* and *trikresol*.

It may be well to say a few words about some of the most important of the foregoing list.

First are several *salts of mercury*. In this connection it has been noticed the more mercury a preparation contains the more powerful its disinfectant action. The best known of these salts are the *bichloride* and *oxycyanide* (q. v.). Schlösser advises its use in 1 to 2 per cent. watery solution and says that it may be used in any capacity to which sublimate is adapted and that it is not so irritating to the ocular tissues.

*Formalin*, 1:1000 to 5000, *salicylic acid* (3 per cent.), *pyoktanin*, *boracic acid* (3.5 per cent.), *chlorine water* (2 to 5 per cent.), *potassium permanganate* (1:1000 to 4000), *sodic benzoate* (five per cent.) and a saturated solution of hydrogen peroxide in water, to which may be added various antiseptic preparations of salts of metals, (iodine, silver, copper, zinc) and many organic compounds also belong to the class of astringents or caustics. A third class of antiseptics are such neutral bodies as *vaselin*, *paraffin*, *castor oil*, *glycerine*, etc., that

act indirectly as antiseptics by furnishing a soil but poorly adapted to the growth of some pathogenic bacteria.

Preparations of certain aniline dyes were, as germicides, introduced into the local treatment of eye diseases by Stilling.\* They were very popular for a time, especially the *yellow and blue pyoktanin* (q. v.), both of which in the solid form and in all their watery solutions were widely used. Interest in them has been more recently revived by Rudini\*\* and others but it has again waned. *Methylene blue and toluidine blue* (q. v.) are also employed by some ophthalmic surgeons in corneal ulcer and in infective conjunctivitis.

*Zinc permanganate*, as dark violet-brown, hygroscopic, crystalline granules, similar in appearance to permanganate of potassium is, like it, used as an antiseptic and astringent wash. It is employed as a bactericidal collyrium in 1:1000 to 500 solutions and should from its chemical composition be very useful clinically. I have prescribed it with much benefit as a 1:3000 solution for the home irrigation of the nasal duct following operation for the relief of lachrymal stricture.

The problem of obtaining the *complete antiseptic action of sublimate* upon the ocular tissues without disturbing unduly the vascular supply of the parts and without inducing discomfort, is solved by the use of a formula proposed by J. A. White. He found that while it is impossible to use, especially in operative work, such *decided germicide solutions* as 1:3,000 in water that strength might be employed as an ointment with vaselin. His formula is:

R	
Hydrarg. bichlor.	gr. 1-6
Sodii chlor.	gr. 5-6
Alcohol dil.	q. s.
Petrolati	℥j

Dissolve the sublimate and the common salt in a few drops of dilute alcohol and mix with the vaselin, which has been previously kept at a temperature of 212° F. for half an hour. Stir until cool. This may be put into soft capsules for individual use, or kept as an antiseptic base for atropine and other ointments. I have prescribed this salve and used it extensively in private, dispensary and hospital work and can recommend it as a most useful application to the sac when a reliable antiseptic is desired. It is my practice to fill the sac with the ointment twice in 24 hours as one of the preliminaries to major operations on the globe. I also prescribe it extensively alone and in conjunction with other remedies for the home treatment of several forms of blepharitis.

\**Revue gén. d'Ophthal.*, 1890.

\*\**Westnik. Ophthal.*, 1899.

J. A. Lippincott, (p. c.) *advises a modification of the ointment, especially in infected ulcers of the cornea, by the addition of lanoline, which takes up the watery solution of the bichloride better than vaselin alone.* His formula is as follows:

R

Hydrarg. bichlor.	gr. i
Sodi chlor.	gr. vi
Petrolati	ʒii
Lanolin.	ʒiii

Clarence P. Franklin (p. c.) reports of *toluidine blue* (q. v.) that "after ten weeks' use of this drug the statement seems warranted that it is a most *efficient remedy in muco-purulent conjunctivitis* and is practically a *specific for the Koch-Weeks and Neisser forms of the disease.* The usual ten days to two weeks' discharge of "*pink eye*" is reduced to four to six days and with this treatment there seems to be less chance of a fresh infection; at least the writer has never seen a return in any instance among many cases.

In *ophthalmia neonatorum* and *gonorrheal ophthalmia of the adult* the purulent process is markedly and rapidly lessened.

It is *to be used three times a day (in 1.1000 solution, dropped into the conjunctival sac)* and alternated with solutions of adrenalin and boric acid. This treatment has given uniform results with no untoward symptom except that, rarely, a patient of pronounced susceptibility complains of slight stinging on its first instillation."

#### **Astringents.**

The members of this group astringe or contract the tissues by reducing the size of the vessels in them, by their superficial destruction, by forming chemical combinations with them or, indirectly, by removing one or more irritants that serve to stimulate their growth or to bring about a state of hypertrophy. Many astringents are also germicides, antiseptics, cauterants, etc., under different conditions of concentration, locality of application and other considerations.

Indeed, the difference between these agents is largely one of degree since astringents are all more or less irritating and, like cauterants, to some extent destroy or alter the parts to which they are applied.

Some astringents, especially those insoluble in water or alkaline fluids, exhibit a feeble and transient action on the tissues and are but mildly astringent and irritant; others are more distinctly irritating and cauterant.

As a rule, astringents of the severer type increase an acute inflammation without exhibiting the distinctive astringent qualities for which they are generally prescribed. For this reason they are *not*

nearly so useful in recent as in chronic inflammations and should be ordered with considerable hesitation in the former conditions.

The vegetable astringents owe their powers chiefly to the presence of tannic acid, tannins or tannates, substances belonging to an ill-defined group, possessing an astringent action as their best defined property. Other organic acids, even *salicylic acid* and the salicylates, are but feebly astringent.

An important group of astringents are *zinc salts*, especially the acetate, iodide, sulphate and chloride, long used in 1-10 to  $\frac{1}{2}$  per cent. solution in the simple forms of conjunctival catarrh and, in recent years, discovered to be a *specific in the treatment of (Morax-Axenfeld) diplobacillus-conjunctivitis*.

*Alum*, either in the solid form (pencil, crystal, powder), as a solution or in combination with other agents, has long been used as a mild astringent in the simple forms of follicular conjunctivitis and trachoma.

*Copper sulphate*, citrate and other salts, especially preparations of the first named, form a well known group of astringents. Like alum, they may be applied in "stick" form. Other astringent copper compounds are the ammoniosulphate, the sulphocarbolate, and cuprol.

*Silver nitrate* and some of its substitutes—especially protargol, argyrol, argentamine, itrol, largin, nargol, actol, argentose and collargol—are generally regarded as our most valuable germicide-astringents. The first named has been employed in the treatment of eye diseases since the earliest times and has since held its place as an essential part of our armament. (See *Silver nitrate* and *Silver salts*.) The comparative clinical values of argentic preparations are discussed under the foregoing and individual headings.

Alexander Randall (p. c.) quotes Risley as teaching 30 years ago that it is wise to use *astringents early*, so as to obtain their good effects and so avoid their irritating qualities which, later, are pronounced and at times outweigh their good effects. He believes that employed in this manner silver nitrate is still the safest and most effective application in purulent conjunctivitis in its secreting stage, aided, generally, by hot applications.

## **Blisters.**

### *Vesicants.*

Vesication is the result of greater irritation than that which merely causes superficial redness of the skin. The serous exudate from the blood vessels due to blistering is not re-absorbed, but remains beneath the epidermis. Agents which produce this condition are termed *epispastics*, *vesicants* or "*blisters*."

If the vesicle is ruptured soon after it has formed, and its epidermal layer removed, a tender surface is exposed. This unprotected area is liable to infection, hence it is better to puncture the blister with a sterile needle inserted at the most dependent part; the fluid then escapes while the loose epidermis protects the denuded area until a new layer of epidermal cells is formed.

Blisters are useful as counterirritants and local depletants and as such have a place in ocular therapeutics.

When it is necessary to apply a blister to the ocular neighborhood this remedy is best employed in the form of *cantharidal collodion*, although the "paper" cerate or plaster may be used. Any of these takes about 5 hours to produce vesication. After the application has remained in situ sufficiently long to blister, the vesication may be much increased by following it with a poultice. The serum should be removed from the pendant bleb by pricking it, after which a soothing cerate should be applied.

I much prefer the *cantharidal collodion*; it is more certain, more cleanly, more easily controlled and localized and probably less painful than the other forms of the "fly" blister.

A non-official *rubber-base plaster containing cantharides* has several advantages over that made from the cerate. After preparing the skin surface the plaster is smeared with a thin film of oil and applied. When it has blistered the part as much as required it is removed.

*Anodyne vesicant* is a good substitute for cantharidal collodion (q. v.) and is made as follows:

Camphor 20 parts, chloral hydrate 30 parts; place in a bottle, liquefy in a water bath and add cantharides 10 parts. Digest at 140° to 160° F. for one hour; strain under pressure.

*Charta epispastica* is paper spread with spermaceti, cantharides powder and other ingredients. This is cut into the shape and size needed and applied for blistering purposes.

#### **Cauterants, Chemical.**

*Caustics.* (See, also, *Escharotics.*)

Included in the list of ophthalmic cauterants are *glacial acetic acid*, *chromic acid*, *dichloroacetic acid*, *hydric chloride*, *iodic acid*, *lactic acid*, *monochloroacetic acid*, *nitric acid*, *trichloroacetic acid*, *gold carbolate* and *paraiodophenol*.

*Iodized carbolic acid* or *solution of iodine* in glycerine-carbolic acid, is a preparation made from iodine 20 parts, phenol 60 parts and glycerine 20 parts. *Applied pure to corneal ulcers* it is one of the most effective cauterants and germicides we possess. I believe it to

be in that respect even better than pure tincture of iodine or pure phenol used alone. Of course, it is to be carefully rubbed into the stained, cleansed and cocainized cornea by means of a pointed tooth-pick or wooden match soaked in the fluid.

*Carbolic acid* is one of the most effective germicides in the pharmacopeia. I regard a 95 per cent. mixture with glycerine as a *good cautery for non-serpiginous ulcers of the cornea*. After *staining* (see Fluorescein), *irrigating* and *anesthetizing the globe* the diseased area should be thoroughly probed with the point of a wooden tooth-pick (not merely dipped) in the solution, excessive fluid being removed from the tooth-pick with blotting paper. This procedure may be repeated several times if necessary. Inasmuch as the phenol whitens the ulcer-area it is easy to regulate the application. Success depends upon using 'as little as possible of the cauterant and tattooing it well into the infected spot. There is little or no destruction of true corneal substance by the carbolic acid and, consequently, a minimum amount of scarring.

I have also found corrosive sublimate a useful application to *corneal ulcers* in a one per cent. alcoholic solution. Stronger mixtures form efficient *escharotics*.

Some of the important ophthalmic caustics are copper salts, nitric acid, fused potash, silver salts, sodium ethylate, chloride of zinc, "Vienna paste" and so-called "London paste," made of equal parts of caustic soda and unslacked lime. For Vienna paste take caustic potash 5, slacked lime 6 parts and make a paste with alcohol.

### **Collyrium.**

*Eye lotion. Eye wash. Eye water.*

In mediæval times this name was given to a suppository or medicated bougie. Later, a powder or solid body applied to the eye, as well as gaseous remedies, was also called a collyrium, but nowadays the term is almost entirely applied to any medicinal lotion, generally antiseptic or astringent, for use as an eye water. As such the collyrium is the commonest form of external application to the eye and includes any solution used for that purpose, many examples of which are to be found in this System.

In the employment of these *detergent and antiseptic lotions* to the eye attention has been directed to the advisability of warming such solutions to the temperature of the human body. Albrand has invented a small instrument by which the antiseptic liquid can be raised to the desired temperature.

A. Duane (p. c.) is careful to direct that they should be filtered and tells the patient to examine them from time to time and make



sure that no precipitate has formed. If a precipitate does form, the solution is either to be filtered or, better, made up fresh. He is convinced that the precipitation of fine crystals from collyria is often the reason the latter are not well borne.

Thompson claims that in prescribing collyria filtered water is better as a diluent than distilled water, since the latter acts injuriously on the epithelial cells.

### **Cerates.**

#### *Cerata.*

Cerates are unctuous solid preparations containing sufficient wax to prevent them from melting at the ordinary temperature of the body. *Ceratum* is made up of white wax, 30 parts, and lard, 70 parts; the other five cerates in the U. S. P. are combinations of wax and lard with some medicament.

### **Collodions.**

#### *Collodia.*

Collodions are *solutions of pyroxylin (gun cotton) in ether* and alcohol and are intended for external applications. Cantharidal collodion is used to blister the skin; all the others are used as dressings. Collodions are to be applied by means of a small brush; the ether and alcohol evaporate and leave the surface covered by a thin film. Flexible collodion is suited to abrasions, etc. The following are the four official collodions, all useful in ocular therapy:

Collodium (Collodion).

Collodium Cantharidatum (Cantharidal Collodion). *Blistering* Collodion.

Collodium Flexile (Flexible Collodion).

Collodium Stypticum (Styptic Collodion).

### **Collyria, Oily.**

In Merck's *Bericht* for 1906 appears the following admirable review of the subject: (The italics are mine.)

"Of late oily solutions of the alkaloids have come somewhat more into prominence for ophthalmological purposes.\* From a practical point of view, they have the advantage over aqueous solutions of being less irritant in their action, and less liable to decomposition. Panas and Scrini\*\* pointed these facts out some time ago. On the other hand, the preparation of an oily alkaloidal solution requires the great-

\*See also *Merck's Annual Reports*, 1904, p. 137.

\*\**Repertoire de pharmacie*, 1898, p. 321.

est possible care, to ensure that it will fulfil its object perfectly. Above all *only the free bases, and not the salts of the alkaloids, must be used, as the latter are not soluble in oils.* This method is used in the solution of eserine salicylate by warming in olive oil at 150—158° C. Whether this alkaloidal salt will put up with such bad treatment without becoming in part decomposed requires to be demonstrated. The fact is that eserine salicylate is not completely dissolved under these circumstances, or it is in part thrown down again when the mass has become cold. To employ a preparation of this kind in ophthalmic practice appears to me to be risky since it is impossible to know how the products of decomposition will behave. It is equally undesirable to attempt to prepare solutions of the sulphate, chloride, etc., of eserine and of other alkaloids by a method of this kind. Whether the oleates and stearates of the alkaloids are suitable for oil collyria is equally open to question; they are certainly soluble in oil, but it is necessary to determine whether the fatty acids are not irritant.

It is thus *safest to use the alkaloids themselves which are sufficiently soluble in oil.* According to Scrini\* the following solutions are to be recommended for practical purposes:

Atropine alkaloid 0.2—0.5 per cent.; Cocaine alkaloid 2 per cent.; Duboisine alkaloid 0.2—0.5 per cent.; Eserine alkaloid 0.5 to 1 per cent.; Holocaine 1 per cent.; Homatropine alkaloid 0.2 to 0.5 per cent.; Pilocarpine alkaloid 2 per cent.

As solvents either *olive oil* or *arachis oil* may be used. Scrini removes the free fatty acids from these oils before use by shaking with alcohol, and removing the alcohol by heating to 120° C. A less desirable plan is to first dissolve the alkaloid in ether, to mix this with the oil, and to allow the ether to evaporate.

The method I should suggest would be to *rub up the finely powdered alkaloid with a little olive oil, to add the remainder of the oil and to gently warm it until solution has occurred.* In so doing, the temperature must be regulated to suit the stability of the particular alkaloid, and the temperature must never exceed the melting point of the alkaloid. Thus for pilocarpine, which is liquid at the ordinary temperature, it is sufficient to warm the oil to 40 degrees; for atropine, cocaine, eserine, duboisine and hematropine a temperature of 50—80 degrees C. is required."

#### **Compresses.**

*Chlorine compounds*, well diluted, form common examples of the

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\**Bulletin Commercial*, 1906, No. 1.



*antiseptic compress and detergent.* Buchardt, for example, advises the following mixture:

<b>R</b>	
Acid. salicylic.	0.7
Chloral. hydratis	1.5
Acid. boric	30.0
Sol. aquæ chlorinatæ (1:20)	1000.0

*Alsol* (q. v.) is generally used in the form of compresses of 5 per cent. strength; one teaspoonful to a cup of boiled water. It is said to have the advantage over boric acid and sublimate of not causing eczema of the lids when used as a local application. It is, therefore, especially valuable for compresses in blenorrhea neonatorum, in conjunctivitis, granular and scrofular ophthalmias, and in warm solution, in chronic cases; also in hordeolosis, in corneal ulcers and iritis, but in such case in solutions of 1-500 and 1-1000. It forms an acid solution with water but is insoluble in alcohol.

#### Counter-irritants.

##### *Rubefacients.*

Redness or increased redness is the result of irritation of the skin. Rubefacients cause a slight increase in the capillary exosmosis, and if the irritation be not long continued or too severe the exudate is absorbed and the parts soon return to the normal condition. They all act as counter-irritants.

Iodine, as the tincture or solution, is very effective. Several applications produce blistering or a caustic effect, but this action can easily be controlled. To *remove the dark stain* from the skin wash the latter with dilute solution of ammonia or a solution of sodium thiosulphate.

Other valuable counterirritants are *Credé's ointment*, *iodopin*, *jequirity*, *abrin*, *jequiritol*, *turpentine*, *oil of mustard*, *alcohol*, *dionin* and *peronin*.

#### Cycloplegics.

(See *Mydriatics*.)

#### Disinfectants.

H. A. Kiefer, (p. c.) on account of the extremely *contagious character of trachoma*, making it possible for the patient to reinfect himself from the various objects with which he comes in daily contact, thus undoing the work that the surgeon has accomplished by operations and other forms of treatment, has made it a practice for

the past seven or eight years *to thoroughly fumigate all the patient's belongings*. This includes his wearing apparel, bed-clothes and especially the pillows, and all other things that pertain to his wardrobe and apartments, and the room he occupies in sleeping. The fumigation is accomplished just before or after operation, or while he is in the hospital. If it is not a surgical case it is done just as soon as possible. The fumigation should be repeated at each operation. In non-operative cases he has the fumigation repeated every few weeks while the case is under his care, just as in operative cases.

Among the disinfectants are most of the antiseptics or germicides. Mention may be specially made of *acetozone*, *antinosin*, *antipyronin*, *enzymol*, *formol*, *glycozone*, *hydrogen peroxide*, *hydrozone*, *chlorine water*, *Labarraque's Solution*, *chlorinated lime*, *lysol*, *calcium permanganate*, *perhydrol*, *phenol* and *chlorinated soda*.

### Electricity.

#### *Galvanism.*

(See Dr. Coleman's section on this important subject.)

### Emollients.

Soothing applications are of considerable value both as excipients for salves, collyria and oily mixtures and alone, as in burns, hyperemia and inflammations of the anterior bulbar segment. Other non-oily preparations have a similar action. Among them may be mentioned *albolene*, *sweet oil of almonds*, *antipyrine*, *cherry-laurel water*, *bitter-almond water*, *belmontin*, "*cocoa*" *butter*, *carron oil*, *castor oil*, *chamomile*, *cod liver oil*, *cold cream*, *cosmoline*, *quince*, *euphrasia*, *hamamelis*, *hazeline*, *milk*, *petrogen*, *petrolatum*, *plantago*, *mucilages*, especially of *acacia*, *tragacanth* and *sassafras pith*, *starch*, *unguentum simplex*, *vaseline*, *vasogen* and *wax*.

### Emulsions.

#### *Emulsa. Emulsiones.*

Emulsions are liquid preparations in which oils or resins are suspended in water by means of a mucilaginous substance. *Acacia*, *mucilage of acacia*, *mucilage of tragacanth* (q. v.) and *yolk of eggs* are the substances most frequently employed, although solutions of *potassa* and of *pancreatin* aid in the emulsification of oils and often enter into the formulæ for emulsions.

### Escharotics.

(See, also, *Cauterants*.)

Agents that applied to the tissues destroy them and produce a slough or eschar. A useful escharotic is *zinc chloride paste*, some-

times employed for the removal of epitheliomata, tubercular growths, *warts* (q. v.), and other superficial tumors of the lid-skin.

#### **Evaporating Lotions.**

Eye waters or lotions containing alcohol or other substances capable of rapid evaporation, and so producing cooling of the ocular region, are frequently employed in ophthalmic therapy. In addition a number of remedies bring about an effect somewhat similar to these and are used for like purposes. Aqueous solutions of alcohol, mixtures containing medicated waters, iced water with tinctures or essences and those agents that are commonly employed with *compresses* make soothing applications to irritated eyes.

#### **Glycerites.**

*Glycerita.* (See, also, *Glycerine.*)

The glycerites are solutions of medicinal substances in glycerin. Although all are intended to be used internally, except glycerite of boroglycerin, yet all are adapted for external application. Glycerite of yolk of egg (no longer official), which should be freshly made when wanted, is frequently used for making emulsions of cod-liver oil and as a vehicle for other substances, e. g., it may be employed as a menstruum in eye lotions.

#### **Hemostatics.**

*Styptics.* (See *Astringents* and *Vaso-constrictors.*)

#### **Irrigating Fluids.**

*Solutions for douching the conjunctival sac.*

The most popular irrigating fluids for detergent and germicidal purposes are weak solutions of sublimate, boric acid, borax, sodium chloride and similar salts.

At one time potassium permanganate was a favorite antiseptic in watery solutions of 1 to 2,000 to 500, both as a collyrium and for the treatment of lachrymal diseases, but in recent years it has fallen into general disuse. Possibly its disagreeable and destructive staining qualities and the discovery of numerous other effective germicides have had something to do with this result. Kalt, who has had much experience with the use of large volumes of irrigating fluids in infections of the eye, also considers potassium, calcium and zinc permanganates (q. v.) to be very valuable disinfectants, and advises their use—1 gramme to 3 litres of water at 25° C. One eye to be irrigated with the solution from two to four times daily, alternating, if need be, with irrigations of warm, sterile water.

One must not forget the employment of *water as a topical application* apart from its use as a carrier of heat and cold. The rule that

*pure* water in douches, irrigations or sprays is not a proper fluid, or is less irritant than normal salt, one per cent. boric acid, or other bland solution for flushing or cleansing mucous membranes, to some extent applies to the conjunctiva. Yet tepid (100° F.), sterile douches of distilled water act well in washing out the sac and are most soothing to the eye, particularly in the presence of mucus, pus or toxins. It does not appear, when judiciously used in an undine (q. v.), with a medicine dropper or in a small irrigator, to increase the mucous or purulent secretion.

Thompson claims that in prescribing collyria *filtered water* is better as a diluent than distilled water since the latter acts injuriously on epithelial cells.

It seems strange that *sodium bicarbonate* is so little used in ophthalmic therapy because it makes a good collyrium for detergent purposes, for irrigating the sac during the treatment of infective diseases of the eye and as a wash for the lid edges in cleansing the cilia, skin and adjoining mucous membrane from dried secretions. For all these purposes a 1 to 3 per cent. solution in distilled water is quite sufficient.

#### Juices.

A few plants described in the various pharmacopeias yield on expression juices that at various times have been employed in the treatment of eye diseases. These, both pharmacopeal and non-official, will be described in the chapters devoted to external drugs. They are nowadays infrequently prescribed in ocular therapy.

#### Lymphagogues.

(See *Dionin*.)

#### Medicated Waters.

J. A. Salding has noticed that his patients were complaining of irritation of the eyes following the use of everyday eye washes containing aqua camphoræ and cherry-laurel water. He has used certain lotions with great success and comfort to his patients suffering with inflamed eyes, but of late, owing to the druggist *dispensing impure or imperfect waters* containing camphor and cherry-laurel, his patients have protested that the lotions were very irritating.

The following have been his favorite prescriptions:

R

Sodii biboratis	0.30 (gr. v),
Acidi borici	0.60 (gr. x)
Aquæ camphoræ	30.0 (fl. ʒ)

Also:

R

Sodii biboratis	0.30 (gr. v)
Aquæ lauro-cerasi	2.0 (fl. ʒss)
Aquæ rosæ	30.0 (fl. ʒi).

On investigating the subject among the local pharmacists, he learned that *no rule prevails among druggists as regards the mode of preparation of these waters*. Some followed one pharmacopeia and some another; some compound laurel water by the Dispensatory from essential oils, whilst others use cherry-laurel water as distilled in France.

As to the camphor water, he mentions that formerly it was compounded by dissolving an ounce of camphor in an ounce of alcohol and then incorporating the resultant powder in magnesia carbonate. The latest pharmacopeia substitutes talcum (*which is inferior to magnesia carbonate*) in place of the magnesia, and there is no explicit direction that the alcohol should be allowed to completely evaporate before the resulting powder is dissolved in water and ample time (a month) allowed to get a perfect solution.

The *cherry-laurel water made according to the Dispensatory from essential oil of bitter almonds, cherry-laurel or peach-pits, is inferior in purity to the imported French water*, and is very irritating to the eye.

He states that if we are to expect good results from the use of these valuable excipients, we must either direct our patients to a druggist who prepares them properly, or prepare our own lotions, or complain to the editors of the standard works in question, urging them to print proper directions in the making of these valuable waters for eye lotions. It would seem a matter of regret that medicines of so much comfort to irritated eyes should have to be laid aside owing to differences in preparation and without some proper substitute at hand.

I am in the habit of prescribing camphor water made after the German method. A piece of camphor or, better, a number of small pieces of camphor in a muslin bag are suspended in a gallon bottle three-fourths full of sterile, distilled water. The bottle is shaken three or four times daily. At the end of a week the camphor bag is withdrawn and the water decanted as needed. I believe that prepared in this fashion camphor water is devoid of irritating qualities when used as a menstruum or adjuvant in collyria, while it possesses all the soothing qualities of stronger solutions.

## CHAPTER IV.

### CLASSIFICATION OF OCULAR REMEDIES, CONTINUED.

*Miotics—Mucilages—Mydriatics and Cycloplegics—Ointments—Poultices—Powders for Dusting and Insufflation—Spraying Solutions—Spirits—Staining Agents—Subconjunctival Injections—Intraocular Medication—Vaso-constrictors—Venesection—Wines—X-Rays.*

#### Miotics.

Those agents that contract the pupil (miotics) generally produce at the same time some degree of spasm of accommodation. They include *arecoline*, *cali*, *eserine* (physostigmine), *eseridine*, *homoarecoline*, *isophysostigmine*, *jaborandi*, *muscarine*, *pilocarpine* and *physostigma*. The most important of these are derived from the Calabar bean, fruit of *Physostigma venenosum* (q. v.). The effect on the pupil of its alcoholic extract was first noticed by Fraser\* in 1862. A year later Argyll-Robertson discovered its effect on the ciliary muscle. Since then the exact extent of the accommodative spasm in the case not only of each miotic but of its various congeners has been carefully investigated—especially since the early discovery of eserine (physostigmine) and other miotic alkaloids. These agents, absorbed by the conjunctival vessels and corneal lymph spaces, filter through the tissues into the anterior chamber and come directly into contact with the nerve-endings supplied to the iris and ciliary muscle. As in the case of cycloplegics the effect upon the iris muscle is much more marked than on the muscle of accommodation, although the effects last much longer in the case of cycloplegics. Miosis from the use of eserine appears before any spasm of the ciliary muscle is manifest. The pupillary contraction often begins in six or seven minutes, reaches its maximum in 30 to 50 minutes, remains at full contraction for 3 or 4 hours and then slowly disappears in 3 or 4 days. The contraction of the pupil is generally more marked than that produced by strong light, although even weakest light rays are able to bring about a still greater contraction. In complete miosis from eserine the pupil is generally irregular in shape.

After the use of a strong miotic the accommodative power is increased. One might say that, in a sense, the emmetrope is temporarily converted into a hypermetrope; the hypermetrope has his refractive

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\**Edinburgh Med. Journal*, 1862., IX.

error apparently increased, while myopia is diminished. Objects are seen farther away and enlarged.

The mydriasis produced either by drugs or other cause may be lessened or may disappear by means of miotics. The pupillary contraction produced under these circumstances is insignificant or nil when the mydriasis is part of a complete cycloplegia. Indeed the measure of the resulting miosis is the amount of the cycloplegia. A one per cent. oily mixture of eserine has no effect upon a mydriasis which is part of a cycloplegia produced by a one per cent. mixture of atropine instilled into the eye three times daily for two days, but its effect on a pupil enlarged from cocaine, euphthalmin, or twenty-four hours after a complete homatropine cycloplegia is quite apparent.

Where contraction and expansion of the pupil is desired this effect may be accomplished by instilling one day a half per cent. aqueous solution of homatropine sufficiently often to maintain marked mydriasis, following it on the subsequent days by a one or two per cent. pilocarpine solution or a quarter of one per cent. eserine solution.

Schäfer\* found full doses of eserine able to overcome and convert into miosis the complete cycloplegia of homatropine.

In 1880 Jaarsina showed (*Inaugural Dissertation*, Leipzig) that *pilocarpine hydrochloride* has practically the same effect upon the eye as eserine except that its action is weaker. One drop of a 1:2800 eserine solution will contract the pupil while it requires at least 1:400 of pilocarpine (alkaloid) to accomplish the same result. Pilocarpine affects *pari passu* both iris and ciliary muscle. The miosis, from both weak and strong solutions, shows itself 15 minutes after the instillation, reaches its maximum in from 30 to 50 minutes and disappears in 20 to 24 hours. Snellen† remarks that the accommodative spasm begins in about 15 minutes and lasts 2½ hours.

The smallest pupil is that produced by a four per cent. solution. Two to four per cent. solutions of the chloride (hydrochlorate, muriate) do not irritate the eye and are better borne by most patients than eserine.

As a diaphoretic (q. v.) pilocarpine is much used in the general treatment of vitreous infiltrations, choroidal exudates, retinal detachment, etc. It is often prescribed with potassic iodide and sweatbaths (q. v.) in the form of hypodermic injections (gr. 1-12 to ½) in slowly increasing doses.

As before mentioned eserine (physostigmine) in full doses and in watery solution is badly borne by some patients—especially

\**Archiv. f. Augenheilk.*, X., 186. 1880.

†*Graefe-Saemisch Handbuch der Augenheilk.*, 100, p. 70.



by Americans. It may cause pain and scleral congestion; sometimes ciliary injection, headache, vertigo and nausea. In these cases of idiosyncrasy I would advise the following:

℞

Eserin. alkaloid.	gr. iiss
Cocain. mur.	gr. i
Ol. olivæ	fl. ʒss.

This mixture will be found very effective and non-irritating.

In this connection one must not forget the value of miotics in treating mydriasis and ciliary weakness or paresis due to causes other than drugs. They not only improve the dulled vision and relieve the discomfort due to the mydriasis as such but, acting as a stimulant to the insensitive nerve-endings, tend to bring about a cure of the condition when it is due to peripheral causes.

Of course the other uses of miotics lie in the treatment of *glaucoma, peripheral corneal ulcer, accommodative asthenopia and to prevent iris prolapse and anterior synechiæ*. This subject is considered elsewhere; it is only proper to repeat that many a patient has been saved the dangers of an iridectomy by the judicious use of eserine, pilocarpine or some other miotic. By their action on the ciliary body, by dragging the mass of the iris towards the pupillary area and thus mechanically clearing the sclero-iridic angle and, perhaps, by lessening intraocular secretion, the tension and other untoward results of the disease are often promptly relieved.

### **Mucilages.**

#### *Mucilagines.*

Mucilages are *solutions in water of gums or the mucilaginous principles* of vegetable substances. They are used in prescriptions to suspend some insoluble substances, or as excipients for forming masses for pills, troches, etc. The mucilages are *soothing to inflamed mucous membranes*; e. g., mucilage of sassafras-pith is largely used in eye-washes.

### **Mydriatics and Cycloplegics.**

An agent that dilates the pupil is a *mydriatic*; one that paralyzes the ciliary muscle and the accommodation, is a *cycloplegic*. Every cycloplegic drug is without exception a mydriatic but a mydriatic is not necessarily a cycloplegic. For instance, weak solutions of euphthalmine or cocaine dilate the pupil, but have no effect upon a healthy ciliary muscle.

The important natural order of Solanacæ, to which belong *Atropa belladonna, Hyoscyamus niger, Datura stramonium, Scopolia*



carniolica, and several other plants of minor importance, produce alkaloids and other agents that dilate the pupil and paralyze the ciliary muscle. These are chiefly atropine, hyoscine (scopolamine), hyoscyamine, duboisine, daturine, homatropine, euphthalmine, *ap oatropine*, *atropine santoninate*, *atrosine*, *belladonna*, *belladonnine*, *ephedrine*, *mydrin*, *eumydrin*, *methyl-atropine bromide*, *mydrol* and *rotoin*.

The salts of the mydriatic alkaloids are generally the hydrobromide, hydrochloride and sulphate.

They are all more or less poisonous, and great care should be observed in their employment; only solutions of the weakest strength that will accomplish the desired result should be prescribed. The instillations should be made, when possible, after meals, and a single drop ought to be put into the sac at a dose. Moreover, when strong solutions are employed the eye should be closed after the instillation and the lashes and lid edges thoroughly wiped dry of any liquid. This is better than applying the finger over the lachrymal sac, or holding the head toward the temporal side and pressing the puncta, as is often advised, although all these precautions may be taken. The toxic symptoms are redness and dryness of the throat, flushed face, rapid pulse, vertigo, weakness of the extremities, a scarlatina-like rash over the whole body, syncope and even death. The antidotes are stimulants, morphia and pilocarpine hypodermically.

These cycloplegic agents differ mainly in the degree of cycloplegia which they produce, the time they occupy in its production, and the length of time that it endures. In the case of atropia the cycloplegia disappears before the mydriasis, the former lasting, after the exhibition of a single drop of a one per cent. solution three times daily for two days, from 7 to 9 days, the latter persisting 10 or even 12 days, according to the condition of the patient and the state of the eye.

It has been noticed that when only one eye has been atropined the vision, as well as the apparent size and distance of objects, is variously influenced by these cycloplegics. Hypermetropes are affected both in the distance and at the near point; the greater the hyperopia the more marked are both defects. Simple myopes see somewhat less distinctly in the distance (owing chiefly to the mydriasis) but are generally able to read if they are under forty and have little astigmatism. Emmetropes see distant objects almost as well as formerly, but cannot read, while astigmics of all conditions are perceptibly disturbed in both distant and near vision.

In addition to the toxic symptoms common to most of the cycloplegics, *atropine* is known to set up occasionally a hyperemia of the conjunctiva and lid skin, accompanied by edema and mucous discharge.

This local irritation is probably due to an *idiosyncrasy on the part of the patient to belladonna*, and is sometimes seen when local applications containing belladonna (liniments, plasters) are applied to the surface of the body elsewhere. All these processes quickly subside when the use of the belladonna application is stopped. Snellen\* agrees with those who believe the atropine erythema and conjunctivitis to be due to impure or decomposed atropine and advises that solutions be always freshly prepared and prescribed with boric acid, salicylic acid, or some other preservative. In any event, it has been noticed that when another cycloplegic (hyoscine, duboisine, or daturine) is substituted for the irritating atropine, the toxic conjunctivitis disappears. Notwithstanding some drawbacks atropine and its salts (especially the sulphate) continue to be the most reliable and best known cycloplegic remedies whether for determining the refractive condition, for giving the eye a "ciliary rest-cure" or for the treatment of active disease.

In 1890 I reported the results of some experiments I had made with mixtures of homatropine *plus* cocaine, and with solutions of atropia and duboisine for the purpose of comparing their relative merits as cycloplegics. The conclusions I then arrived at were:

In the shape of watery solutions probably less than ten per cent. of the dissolved alkaloid becomes absorbed in such a way as to affect the eye, the remaining ninety per cent. or more being carried off into the nasal duct or flowing over the cheek with the tears.

Mixtures prepared with vaseline, cosmoline, lanoline and similar menstrua, or, as in Lang and Barrett's experiments,† castor oil, are much longer retained in the conjunctival sac. The drugs thus longer kept in contact with the ocular and palpebral surfaces undergo, as Green suggests, a much more extensive absorption and produce a still more pronounced effect.

They are absorbed by the blood vessels and other absorbents of the cornea and conjunctiva and not by those of the nose and throat. But such oily and greasy mixtures have this serious drawback: they leave a thin film upon the corneal surface which interferes with the examination of the eye especially when one wishes to determine its refractive condition.

Gelatine lamellæ or discs appear to be the most useful form in which to apply agents to the eye for the purpose of securing their

\*Graefe-Saemisch, *Handbuch*, 2d Edition, 100 Lieferung, p. 60.

†The action of Myotics and Mydriatics. *Ophth. Hos. Reports*, vol. xi., pp. 130 and 219.

fullest mydriatic and cycloplegic action. These undergo a slow, regular and complete absorption when put into the conjunctival sac.

The addition of cocaine to almost all the alkaloids used in ophthalmic practice undoubtedly increases their peculiar effects.

From the foregoing results and after much experimentation on the subject, I concluded that *the most decided cycloplegic effects of homatropine are obtainable from its employment in the gelatine disc form, associated with cocaine.*

In their most convenient and stable shape these discs cannot be made to hold more than gr. 1-25 of these alkaloids; hence I was necessarily restricted to the use of gr. 1-50 each of Merck's homatropine and cocaine.

Subsequently I experimented with the gelatine discs just described, with discs containing gr. 1-25 of homatropine alone, and with various solutions in water of tropa-cocaine, homatropine plus cocaine, duboisine sulphate, atropine sulphate, hyoscin hydrobromate and hyoscyamin sulphate.

For the determination of the refractive condition and with the idea of making the conditions of the comparative test as constant as possible I chose those patients in whom I could employ a number of agents at proper intervals, and whose refractive state would be most likely to afford reliable tests. These were put under the influence of the particular cycloplegic and their refractive state determined by skiascopy. Every case was carefully worked out by T. A. Woodruff, who is an expert skiascopist.

As a result of these and other experiments I have reached the following conclusions, some of which are modifications of the propositions contained in my first article:

1. If two gelatine discs containing gr. 1-50 each of homatropine *plus* cocaine be placed in the conjunctival sac at an interval of twenty minutes, *the eye being all the while kept closed*, the ciliary muscle will in most instances be found to be fully paralyzed in from seventy to one hundred minutes after the introduction of the first disc.

2. In persons under twenty-five years of age, or whenever ciliary spasm is suspected, the best results are obtained by the use *in another twenty minutes of a third disc or one containing gr. 1-25 of homatropine alone*, the examination in that case being best made between ninety and one hundred and twenty minutes after using the first disc. The first two discs containing cocaine are sufficient to furnish the chief advantage which, in my opinion, resides in that alkaloid, viz: of increasing the absorbing powers of the cornea for agents combined with

it, while the increased dose of homatropine produces a more thorough relaxation of the ciliary muscle.

An eserine disc (gr. 1-1000) inserted the following morning will enable the patient to do near work within an hour or two.

3. The discs should be inserted on the top of a damp camel's hair brush and should always be applied to the ocular conjunctiva at its inferior and outer surface, the patient looking up and in, while the lower lid is drawn down. Any adherent or sticky gelatine may be easily wiped off the palpebral edges with a damp cloth or a piece of wet absorbent cotton, before making the examination.

In my preference for these discs over any solution of atropia I wish to state that I do so only on the grounds of the quicker and more evanescent cycloplegic action of the former.

*I always use atropia whenever I possibly can, and particularly if, in my judgment, the patient would be benefited by ciliary rest*, as many of our cases are. But for the business man, the clerk, the bookkeeper, the doctor, the school teacher, *et hoc genus omne*, ten days of ciliary or any other kind of rest is usually impossible. It is with them either an examination for glasses of the optician-and-jewelry-store order or a transient cycloplegia.

*Every agent that dilates the pupil increases the liability to attacks of glaucoma.* The more energetic the agent and the longer the mydriasis, the greater is that danger. In patients past middle life, in those whose tension is above normal or when the ophthalmologist has reason to suspect the presence or imminence of glaucoma, no powerful mydriatic should be used, but *ephedrin*, *euphthalmine*, *homatropin* (q. v.) or some other agent causing a transient mydriasis should be employed. Its action can thus be controlled by eserine.

A. J. Abbe (p. c.) always uses *atropine as an ointment with petrolatum* and believes that in this form it is not only superior to the solution for all the purposes accomplished by that drug, but he thinks the routine use of the salve form is safer than the solution, because it cannot well be swallowed by mistake and may be placed in the hands of the patient with less anxiety than "drops."

In my experience cocaine or any of its salts alone is not a very satisfactory mydriatic. Its action in mild (1-10 to  $\frac{1}{4}$  per cent.) solutions is too weak, while in larger proportions it induces dryness of the cornea, causes clefts between the anterior epithelial layers, and makes it easy to remove these protective lamina. However, in conjunction with other mydriatics it acts just as it does with miotics and most other agents—to intensify their proper medicinal action. Thus the most powerful cycloplegic and mydriatic we possess is a mixture of hyoscine, cocaine and atropine. Again I must remind my reader

that for half an hour after instilling the stronger cocaine preparations, the eye should be kept closed most of the time—to prevent the evil effects of the drug on the cornea.

According to Ohlemann (46) a mixture of several mydriatic alkaloids has long been used in France; for example, *atropine*, *duboisine* and *cocaine* combined furnish a cycloplegic mixture more powerful and less toxic than any of its constituents. In the same way a most active miosis results from combining eserin and pilocarpin, while pilocarpin and cocain instilled simultaneously produce a marked miosis without lessening the anesthesia from the cocain. This property *dionine* (q. v.) also possesses in common with cocaine.

Darier uses euphthalmine chiefly for *ophthalmoscopic purposes* and finds that a single drop of a half per cent. solution is quite sufficient to produce effective and transient dilation of the pupil with little or no paresis of accommodation. Winselmann uses a still weaker solution (0.25 per cent.) because he finds stronger doses occasionally cause ciliary paresis and mydriasis lasting 24 hours. I much prefer to any of these agents a mixture of cocaine and euphthalmine (q. v.).

Another effective mydriatic is the proprietary agent called *mydrin*. This is a white powder composed of one part of homatropine to 100 parts ephedrine in a 10 per cent. aqueous solution, and intended to produce an evanescent mydriasis, mainly for *ophthalmoscopic purposes*. After the use of one drop Oliver (14) noticed that the pupil reaches its maximal dilatation of 4 to 7 mm. in 30 to 35 minutes, and returns to normal in four to six hours' time. The mixture is more effective as a mydriatic than either of its constituents alone.

Groenouw (45) used the following as a *substitute for mydrin*:

℞

Ephedrin, hydrochlor.	gr. vii
Homatropin.	gr. 7-100
Aquæ dest.	5 iiss

The dilatation of the pupil begins shortly after instillation and remains at its maximum for half an hour, thus affording ample time for an ophthalmoscopic examination.

#### Ointments.

*Unguenta. Salves. Unguents.*

Ointments are defined by Thornton to be soft, fatty solids of such consistency that they liquefy at the temperature of the body. They are mostly intended to be applied by inunction. The basis for ointments may be *lard*, *benzoinated lard*, simple ointment, hydrous wool-fat (lanolin), ointment of rose-water (cold cream), petrogen, vasogen,

various paraffins, hard petrolatum, glycerite of starch, boroglycerin or similar agents. Ointments should be perfectly smooth; that is, they should not contain any undissolved, hard, or gritty particles. When it is desired to incorporate into an ointment a substance which is insoluble in the basis, it is often necessary to use a small quantity of alcohol, water, or glycerin as a solvent before mixing with the ointment-base. Thus in making an ointment containing *resorcin* the latter should first be rubbed well with a little alcohol, water, or glycerin before it is mixed with the basis; iodine may be readily dissolved by adding to it a small quantity of potassium iodide, then a few drops of water, and so on.

A novel ointment and lotion *diluter* has been suggested by Charles Wray (*Ophthalmoscope*, Sept., 1908) for the accurate and aseptic reduction of the strength of salves and collyria. It consists of a hollow cylinder (open at both ends and marked off into equal parts, 1, 2, 3, 4, etc.) in which works an accurately fitted solid glass piston. To dilute an ointment with vaseline—to, say, one-fourth—insert the diluter into the ointment and draw up the piston until the ointment reaches the line marked 1. Then remove the instrument and cleanse the end with sterilized wool; insert it into the vaseline, drawing up the piston until the mixture reaches 4; after which the contents are to be pushed out into the lid of the ointment pot and mixed well together by means of the glass piston. The stronger dilutions should be made first and the weaker ones last, on the principle of diluting what has already been diluted.

As regards *lotions*, they may be diluted in the same way by fixing on the distal end of the instrument a metal cap perforated in the center.

#### **Poultices.**

Poultices are generally made of ground flaxseed, elm bark or other substances mixed with enough boiling water to make a stiff mass, which is inclosed in a *double piece of gauze or muslin* and applied to the surface as hot as it can be borne.

They should rarely be used in inflammations of the eyeball. The practice of applying *poultices of tea-leaves, chamomile flowers, or bread*, indulged in so frequently by the laity, generally aggravates inflammatory affections of the conjunctiva and cornea and may even convert a trivial and self-limited disease into a severe or serious one. They are occasionally of benefit in styes, abscesses and other local infections of the lids, but they should not be applied for long periods and should, as much as possible, be confined to the parts affected.

D. T. Vail (p. c.) in *blepharitis ulcerosa*, beats white of fresh egg with crystals of bluestone until turquoise-colored curds form.



This is applied as a poultice, after thorough cleansing, all night for three nights.

Collargol has been used in *blennorrhœa neonatorum* and other infective processes, but its chief use is in the preparation of *Credé's ointment* which<sup>3</sup> is composed of collargol 15 parts, water 5 parts, white wax 10 parts and benzoated lard 70 parts. In ophthalmic surgery it is valuable antiseptic counterirritant, to be *applied as a poultice to the lids* in most serious cases of intraocular inflammation. The ointment is smeared over the closed lids and eyebrows at night, a bandage is applied and the greasy mixture washed off with warm water in the morning.

### **Powders for Insufflation.**

#### *Dusting powders.*

Of the agents especially used in the form of powder for dusting or insufflation, most are antiseptics, astringents and protectives. A few of them are *europhen*, *aristol*, *dermatol*, *calomel*, *formidine*, *galanols*, *gallicin*, *iodoform*, *iodol*, *iodoformogen*, *lenicet*, *loretin*, *calcined magnesia*, *orthoform*, *sanoform*, *sugar*, *thioform*, *xeroform* and *zincl*.

F. A. Morrison (p. c.) uses gum arabic as a base for the purpose of insuring prolonged contact of the drug with the eye. For example, in refraction work he employs the following mixture instead of a solution or the gelatine disc:

R̄	
Homatropin. hydrobrom.	ãã gr. i
Cocain. hydrochlor.	
Pulv. acaciæ	gr. v

A little to be placed on the eye-ball, or in the sac, near the outer canthus.

In *phlyctenular keratitis* Ray H. Dean (p. c.) uses xeroform as a *dusting powder* not only to the cornea and conjunctiva but on the skin surface of the lids. He also employs it where iodoform powder is usually required. In the form of dry xeroform gauze applied to the eye with a bandage he finds it of great value as an antiseptic dressing.

*Gallicin* is used as a *dusting powder* in many external diseases of the eye, such as the various forms of chronic and subacute conjunctivitis or it may be applied with a camel's-hair pencil to phlyctenules or in superficial ulcer of the cornea.

This is the method advised by me some years ago, but I would strongly urge the instillation of a couple of drops of holocain (1-5



per cent.) before applying the powder, because it is likely to irritate and cause pain.

### Schleich's Infiltration Anesthesia.

(See *Anesthesia, infiltration.*)

### Spraying Solutions and Mixtures.

I am indebted to J. H. Claiborne (p. c.) for the following notes: "I have had rapid and satisfactory results, especially in the treatment of acute catarrhal infections of the eye by the judicious use of *eye sprays*. I trim the eye-lashes and allow a few drops of a 2 grain to the ounce solution of silver nitrate to roll over the exposed mucous membrane, then I spray thoroughly with a solution of cocaine, about  $\frac{1}{4}$  of a medicine dropper full of a 2 to 4 per cent. solution and about 15-30 drops of borolyptol to an ordinary spray-tube of water. In the summer I use ice water and in the winter warm applications. I then instil a drop of adrenalin chlor. 1-1000. At times I substitute (particularly in woman) 1 gr. to the ounce of nitrate of silver and in very sensitive cases I use only the borolyptol, cocaine and adrenalin, supplementing this with appropriate treatment at home. To many people the spray is delightful; to others it is disagreeable. I use about 20-30 pounds pressure—less if disagreeable. On trial I find I use about 2 to 15 grains of cocaine and the same amount of borolyptol.

I also prescribe a spray at home which in nervous people is easier to use than drops. I tell the patient to pull over the lower lid well and look up while some one else sprays the following into the cul-de-sac freely 3 or 4 times a day:

R

Cocain. hydrochlor.	gr. i
Sodii bicarb.	gr. v
Sodii chlorid.	āā gr. v
Sol. adrenaline chlorid. (1:1000)	fl. ʒi
Aquæ dest. ad.	fl. ʒi

I use the above as adjuvants in all cases of conjunctivitis, but I have found the results most brilliant in acute catarrh—particularly, 'pinkeye.'"

### Spirits.

#### *Spiritus.*

Spirits are *alcoholic solutions of gases, volatile liquids, or volatile solids*. A large number are solutions of volatile oils in alcohol and are often used as flavoring agents. With the exception of the spirits of nitrous ether, ammonia, whisky, and brandy, they all make cloudy or milky mixtures when added in considerable quantities to water.

This turbidity is due to the separation of the volatile oils or other volatile substances which they contain. Being strongly alcoholic, they are good solvents for resins, oleoresins, and resinous extracts, and they do not cause precipitation when added to fluid extracts and tinctures.

They are usual additions to evaporating lotions and liniments, to be applied to the ocular region for the relief of asthenopic symptoms.

### **Staining Agents.**

#### *Corneal stains.*

These are employed chiefly in mapping out defects in the corneal epithelium—in particular to determine *the limits of corneal ulcer* and the exact locality of foreign bodies. Dropped into the conjunctival sac they stain the defective area so that the contrasting color (green, yellow, red, blue) is readily seen.

Chief among them are *fluorescein* and its compounds with sodium and potassium (q. v.) but there are several others about as effective. Among the latter are *escorcin*, *methyl violet*, *methylene blue*, *blue* and *yellow pyoktaniin*, all of which are described in the chapters devoted to External Drugs.

### **Subconjunctival Injections.**

Subconjunctival injections of various agents, such as the normal salt solution, bichloride of mercury, cyanide of mercury, etc., are used in a number of affections of the eyeball, as for example, *iritis*, *scleritis*, *choroiditis* and *retinitis*, *detached retina*, etc. The conjunctiva should be anesthetized with holocain or cocain, the point of the sterile hypodermic needle inserted near the margin of the cornea, well into the subconjunctival tissue, and a few (3 to 10) drops of the solution injected. The pain is not severe when mild salt, borax or boric acid solutions are employed but it is quite severe when bichlorid, cyanid and strong (5 per cent. to 20 per cent.) sodic chloride preparations are used.

Although von Rothmond in 1866 recommended *subconjunctival injections*, using them for the removal of corneal opacities, to Darier\* is due the credit of definitely stating the conditions under which solutions (especially of mercuric chloride) can be best employed in this way. He used as strong a mixture as 1:1000. The eye was cocainized and a syringe of injected beneath the conjunctiva 7 mm. from the sclerocorneal junction. Very little pain or irritation followed and Darier then and since has recommended the bichloride treatment in cases of incipient creeping ulcer, minor degrees of parenchymatous

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\**Annales d'Oculistique*, 1893. Vol. 109.

keratitis, acute choroidal infiltrations, leucic disease of the eye and infected traumatic lesions. The injections are given daily or less frequently in full or decreasing doses, according to the requirements of the case. Although the use of sublimate and other mercurial remedies was followed by good results in the hands of many other observers it was occasionally noticed that the injections were causing pain and set up serious reactions. For this reason and because it was believed that the value of the subconjunctival injections rests not so much in the specific character of the mercurial employed as in the derivative or stimulating effects upon the lymph and vascular circulation of the cornea and eye interior set up by the injection, less irritating salts were employed. The experiments of Mellinger\* showed conclusively that we can with less pain and danger to the patient, obtain from common salt (1:10 per cent. solution) practically all the resolvent effects of mercuric chloride. This safe and painless procedure has been used with some success as an adjunct to the treatment of detached retina, iritis with posterior synechia, all forms of corneal ulcer and in many cases of scleritis. In its turn it will probably, in most cases, have its place in ocular therapeutics taken by dionin (q. v.) whose action is, in some respects, similar. I am in the habit of using 1 to 5 per cent. subconjunctival salt injections as a continuation of the treatment by dionin when that drug has ceased to produce the conjunctival edema without which its therapeutic value is practically nil.

Darier (*Thérapeutique Oculaire*, p. 32) in addition to its employment in *hypodermic* and *intravenous injections* (0.06 to 0.08 centigramme) advocates the use of enesol *subconjunctively*, and believes it is likely to replace mercuric cyanide and other salts of mercury for all these purposes. It is less irritating and less painful than they and gives excellent therapeutic results.

In his earlier experiments with this method Darier advised that a solution of 1:1000 mercuric chloride be injected into the cocaineized eye, especially in serious cases of corneal and intraocular infection. He found that from two to five doses, introduced beneath the ocular conjunctiva about 7 mm. from the sclero-corneal junction gave the best results. An injection could be given daily or at greater intervals according to the requirements of the case. The conjunctival swelling and ocular irritation soon disappeared. Darier believes these injections to be of much value in the milder forms of parenchymatous keratitis, beginning "serpent" ulcer of the cornea and in some acute infil-

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\*Archiv. f. Augenheilk, 32. 1896.

trations of the choroid. He also found them valuable in intraocular syphilitic lesions and in infected operative and other wounds of the eyeball. He ascribes their *modus* chiefly to the fact demonstrated by Gallemaerts\* and others that solutions of mercurial salts injected beneath the ocular conjunctiva find their way into the interior of the eye.

The proposal to disinfect the ocular contents by means of subconjunctival injections gave rise to a war of words and much laboratory work and clinical experimentation both in this country and abroad. It was finally concluded that in whatever way it was accomplished this method of treatment is valuable, that it is not necessary to use such strong solutions (often followed by disagreeable consequences) and that probably good results that flowed from their use is more dependent upon their counter-irritant and depletive action than upon their germicidal or anti-toxic effects. For these reasons ophthalmic surgeons now generally make use of solutions of common salt instead of mercurial and other compounds. Beginning, as a rule, with five drops daily of normal salt solution the injections are increased to a point where a slight degree of discomfort is experienced; the amount or strength of the injection should not be increased or used so frequently as to cause pain, lachrymation or continued foreign body sensations, chemosis of the ocular or palpebral conjunctiva, subconjunctival hemorrhage, pericorneal injection or haziness of the cornea.

In detachment of the retina subconjunctival salt solution, as an adjunct to other treatment, should begin with the usual one per cent. solution and be gradually increased until 3, 4 or even 5 per cent. strengths are employed.

This method of exhibiting various ophthalmic remedies undoubtedly possesses virtues superior to the ordinary plan of instillation or massage. It has been demonstrated that the good results so often seen are, in some instances, due to a form of local counter-irritation combined with an increased ex- and endosmosis. In other words, the *subconjunctival use of normal salt solutions* is generally as effective as the use of 1:10,000 peroxide or cyanide of mercury solution. Almost every agent ordinarily effective in ocular diseases has been used in this way and as the local irritation is generally slight and the effects, when the method is rationally employed, are good it ought to have a wider vogue. Risley (27) has not seen an instance of inflammatory reaction, or any thickening of the conjunctiva or subconjunctival tissues, or any adhesion of the tissues to the sclera, even when the salt injections had been made daily or on alternate days continuously for

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\**Bull. d'Acad. Royal. de Med.*, Belge. VII., 1893.

many consecutive weeks. He believes the beneficial action is due largely to the protective influence of the serum-albumin poured out into the aqueous humor. The injection of neutral, saline solutions of low specific gravity rapidly dilates the channels of exit and at the same time dilutes their contents, and so by a rapid diffusion of fluids hastens the flow of the diluted lymph and albuminoid substances through their normal channels. It is probable, also, that the emptied spaces are at once refilled by a fresh supply from the original source which will be richer in albuminoid substances and, withal, would carry a fresh nutritive supply to the tissues.

Schiele (17) found the *subconjunctival action of sodium iodate* of especial value. He used 0.10 solutions (not boiled but freshly prepared) to which from one to three drops of a 1 per cent. solution of *acoin* (q. v.) were added to each syringe-ful to make the injections painless. The conjunctiva was first anesthetized by instillations of cocain, or cocain and atribilin. Pain after the injections was either very slight or entirely absent. No edema of the conjunctiva or swelling of the eyelids was seen in any case. The injections were made far back from the cornea, to avoid injuring any of the large conjunctival vessels. No adhesion between the conjunctiva and sclera, or necrosis of the tissue was observed. These injections of a syringe-ful of 1-1,000 sodium iodate solutions were repeated not oftener than every three or four days, and were *used in iritis, cyclitis, keratitis, secondary glaucoma and panophthalmitis* with marked relief of the pain, which decreased decidedly within a few hours, disappeared entirely or was slight afterwards.

Maggi (*Annali di Ottalmologia*, Fasc. 3-4, 1907) has compared the results of subconjunctival injections of *bichlorhydrate of quinine*, 1 to 400, of *chloride of sodium*, 0.75 per cent., and of *sublimate*, 1 to 5,000. He prefers weak quinine injections, as they act best in causing the absorption of pus from the anterior chamber and in limiting infective processes in the cornea. The treatment is more efficacious the earlier it is commenced and the weaker the infection.

T. A. Woodruff first drew my attention to the employment, subconjunctivally, of the following mixture in *iritis, corneal ulcer*, etc. I find that it acts remarkably well, produces very little local irritation and is an improvement upon salt solutions and any mercuric preparation that I have hitherto used. The formula is as follows:

R	
Iodin.	gr. 1-7
Potassic iodid.	gr. 1
Aquæ dest.	fl. ʒi

Bull (18) believes the efficiency of the various solutions to be due not to increased local acceleration of the lymph-currents, the so-called leucocytosis, or to the antiseptic action of the remedies employed, since the presence of such processes cannot be demonstrated in the tissues of the eye following the injections. The chief change seems to be in the composition of the aqueous humor. The latter becomes hemolytic and richer in albuminoids from the irritating action of the injections, which cause congestion and increased transudation from the blood-vessels of albuminoids with which, it is now known, the protective substances of the blood are always found. He has used sodium chloride, sublimate, mercuric cyanid, and hetol (q. v.) of varying strength. No important differences in mode of action or effect were seen between salt solutions and those of mercuric cyanid. The latter (even when cocain or acocin was added to the 1:5,000) solution before injection, always caused a great deal of reaction, severe pain, and conjunctival inflammation, and was followed by persistent chemosis and hypersensitiveness of the conjunctiva. Hetol (sodium cinnamate) was used in a 1 per cent. solution, half a gram being injected, after cocain, at first every other day. It seemed to influence favorably the course of the disease in herpes and interstitial keratitis, to be of benefit in hastening absorption in acute uveitis, but was of no use in chronic cases, notably in scleritis. Bull believes that this method does not bring about any more rapid or favorable results than those we have hitherto employed in affections of the cornea, uveal tract, or retina. In orbital cellulitis of an infective nature, however, bichlorid (1:1000) did exert a very favorable and unusually rapid effect in hastening the suppurative stage.

An example of the effectiveness of the subconjunctival use of inert substances is deWecker's recommendation of *gelatin* (q. v.). Noting the remarkable results of gelatin injections in aneurisms of the aorta he was led to employ the same material, either alone or in combination with 3 to 5 per cent. solutions of chlorid of sodium, subconjunctivally instead of the painful injections of 10 to 20 per cent. solutions of salt. He speaks encouragingly of the method of modifying the osmotic currents more particularly in cases of intraocular hemorrhage. The injections are painless and they are not followed by any reaction if properly *sterilized solutions of isinglass* are used.

Karl Wessely's\* experiments with subconjunctival injections of salt solution resulted in his belief that they act through their osmotic action upon the internal tissues of the eye. Analysis has proved that

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\*Abstract in the *London Lancet*, April 4, 1903.



their penetrating power is very small, that they do not produce their effect as lymphagogues nor, so far as regards sodium chloride injections, by any direct action in setting free leucocytes. They really act as powerful local stimuli to the conjunctiva and even when frequently employed have no injurious effects. The nerves of the conjunctiva, thus energetically stimulated, act in a reflex manner, presumably through the vaso-motor nerves in the vessels of the adjoining vascular territory, leading to dilatation of the ciliary area. The hyperemic condition of the ciliary vessels renders their walls more permeable, and the result is the secretion of aqueous humor containing much albumen, in place of the normal aqueous, which contains none. Wessely further observes that the accompanying process of inflammation, particularly edema, has long been regarded as a safeguard to the organisms without particular reason. Bacteriological researches have, however, shown that the serum of normal blood contains several protective materials which play an important part in the strife against lower organisms, and that these materials, to which the names of *bacteriolysins*, *agglutinins*, *hemolysins* and *precipitins* have been applied, are in all probability associated with the albumen of the serum. The question immediately arises whether, as the normal aqueous humor is almost destitute of albumin, while that secreted after subconjunctival injections contained a notable proportion of albumin, the beneficial effects observed might be due to the presence of ferments, enzymes, or solvents eliminated with it. Experiments made with animals rendered immune with the blood of an ox showed that the normal aqueous humor has no power of dissolving bovine blood-corpuscles, and hence contains no hæmolysin. But if a subconjunctival injection were made, of a 5-10 per cent. solution of common salt, and after the lapse of half an hour the aqueous was withdrawn, it quickly dissolved an equal volume of a 5 per cent. mixture of blood corpuscles—a very interesting result. Still other experiments demonstrated clearly that the power of solution in the newly secreted aqueous was in direct proportion to the amount of albumin that the fluid contained.

*Subconjunctival injections of air*, sterilized by drawing it through the needle of the hypodermic syringe heated to redness in an alcohol flame, have been used for tubercular disease, sclerosing keratitis, and by Terson in ordinary keratitis and ulcer of the cornea. Possibly this method was suggested by the use of the same remedy for intraocular injections (q. v.). The air (1 or 2cc.) is injected every three to eight days, or when the previous dose is absorbed. The eye should be well cocainized when little or no pain is experienced. Terson ascribes the



action of the remedy to the same influence observed on injecting air into the tissues for neuralgia.

In *serpent ulcer*, in *infections following cataract extraction*—indeed, in any *severe purulent process involving the eyeball*—H. W. Woodruff (p. c.) strongly recommends subconjunctival injections of mercuric cyanide, after the method of Bourgeois, as follows:

The conjunctiva is anesthetized by three or four instillations of 4 per cent. cocaine solution during ten or fifteen minutes. Then *eight minims of a solution of cyanide of mercury, 1 to 1,000, with four minims of 4 per cent. cocaine added, are injected beneath the external conjunctival cul-de-sac with the hypodermic syringe*. When the needle comes in contact with the external wall of the orbit the point should be turned slightly inward and the needle plunged deeply into the tissues, *so that the injection is more than subconjunctival*. The tissues of the orbit surrounding the eyeball are bathed with this solution. The swelling and edema which follow are quite severe, but this is probably beneficial rather than harmful. He has used these injections in thirty cases with signal success.

That the subconjunctival use of powerful antiseptics is occasionally followed by disagreeable results is well established. For instance de Schweinitz (*Ophthalmic Record*, April, 1907) noted a case of *intra-ocular tension following a subconjunctival injection of a solution of mercury cyanide*. The patient, a man, 29 years old, had a marked uveitis of the left eye which had begun with a conjunctival hemorrhage, and later a hemorrhage into the vitreous had occurred. His general condition was good. Vision of the left eye, after correction of 1 D. of hyperopic astigmatism with its axis 180 was normal, vision in the left eye was 6-60, tension below normal, anterior chamber deep, iris discolored and its pupillary area thickened and elevated. There was a fine, punctate keratitis, the vitreous was filled with thick opacities through which the fundus showed dimly, revealing a disk with blurred margins and very dark tortuous veins. There was a marked contraction of the visual field on the upper and temporal sides. Scopolamin mydriasis, mercurial inunctions followed by iodide of potassium and pilocarpine diaphoresis gave very satisfactory results, and vision finally rose to 6-20.

During the treatment ten subconjunctival injections of physiologic solution were given with apparent improvement. After the treatment had been continued for five weeks a subconjunctival injection of ten minims of cyanide of mercury 1-1000 in the upper and outer portion of the bulbar conjunctiva between the superior and external rectus was given. Within a few minutes there was severe pain and in half an

hour intense injection of the eye ball, marked steaminess of the cornea obscuring the underlying tissue, decided rise in the ocular tension and reduction of visual acuity to hand movements. Hot compresses and instillations of a solution of eserine 1 gr. to the oz. with adrenalin 1-1000 afforded some relief. The attack lasted five hours, treatment being continued, but the adrenalin was omitted and pilocarpin, 2 grs. to the oz. was substituted for the eserine. Next day the only traces of the disturbance were a small patch of congestion over the area of the injection and a tenderness of the globe.\*

#### **Intraocular Medication.**

Following Koster's attempt to cure *intracocular tuberculosis* by the injection into the anterior chamber of sterile air after the aspiration of a portion of the aqueous humor, Terson and others have experimented with the same agent in subconjunctival form. Farnière† believes the methods to be of considerable value, especially in conjunction with other treatment, and finds it entirely free from danger. He thinks it is particularly effective in the *superficial forms of keratitis* and *scleritis*, *kerato-conjunctivitis* of phlyctenular origin, *ulcer of the cornea*, central or marginal, with or without hypopyon.

This treatment *relieves in particular the ocular pain, photophobia, lachrymation and blepharospasm* of these diseases. It also increases the remedial effect of other remedies given with it, especially when they are exhibited as powders and ointments. Holding the lids apart with the thumb and index finger and in the other hand a sterile hypodermic syringe filled with air drawn through an alcohol flame, the point of the needle is entered, at a tangent, near the corneal margin. It is then depressed and the point pushed 5 or 6 mm. beneath the conjunctiva. Slowly the piston is gently but firmly pushed home until the conjunctiva is "blown up" and so that the mucosa at the corneal margin is all around distinctly raised above the cornea itself. Elevation of the entire bulbar conjunctiva is of course possible only when there are no scleral adhesions.

Unlike subconjunctival injections of bichloride and cyanide of mercury (q. v.) Farnière says that sterilized air has a *calmative* effect.

The treatments should not be continued too long. They may be repeated, on an average, *every three days*, and in ordinary cases five injections are given, thus occupying fifteen days in all. If decided relief is not obtained at the end of that time the method should be abandoned for some other. It does not pretend to *cure* the diseases men-

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\*Abstract from *Ophthalmology*, July, 1907.

†*La Clinique Ophthalmologique*, July 25, 1908.

tioned above; it aids in their cure. Finally, the remedy is *not limited to tubercular cases*, but is applicable to all forms of the diseases mentioned.

### **Vaso-constrictors.**

Agents that produce contraction of both arteries and veins of the anterior plexus, accompanied by blanching of the conjunctiva, complete whitening of the sclera and more or less pallor of the palpebral skin. The conjunctival vessels are reduced to microscopical threads and the superficial veins generally require a lens to locate them.

We are principally concerned in the local vessel-contractors which are chiefly *cocaine*, the majority of the *cycloplegics* (q. v.), and the *suprarenal extracts*. The two first are fully discussed elsewhere; of the last named it may be said that since Bates\* drew our attention to the effects of an *extract of suprarenal capsule* upon the eye and showed that it acts as a powerful vaso-constrictor, Takamine, through Parke, Davis & Co., put at our disposal *adrenaline hydrochloride*, a much more convenient and cleanly preparation of the suprarenal body. One of the early preparations was, the liquid extract of suprarenal glands made with glycerine, one part being equal to one part of the fresh gland. From 1 to 10 per cent. of this was employed in experimenting upon the eye. Since that time numerous substitutes for this useful agent have been marketed but it cannot be said that any of them is more valuable in eye surgery, although several of them are cheaper and probably of equal importance from the ophthalmic standpoint.

Besides adrenal, adrin, atrabilin, hemostatin, *suprarenaline*, *adrenin*, *suprarenin* (both animal and synthetic) we have *hemisine*, *renoglandin*, *adnephrin*, *paranephrin*, *renastyptin* and a dozen other proposed substitutes for adrenalin all of which will be described at greater or less length in the alphabetical list of external drugs.

Most of them are, like the original adrenaline chloride, sold as 1:1000 solutions with or without some preservative (chloretone, common salt, boric acid, phenol, etc.) and protected from light and air in glass-stoppered, amber bottles.

It is still believed by some surgeons that the vaso-constrictor qualities of suprarenal extract can be utilized in the treatment of external diseases of the eye.† Such a position ignores the well-worn pathological idiom that local distress is the cry of the affected parts for blood. The continual hyperemia of the oculo-vascular system is merely nature's effort to meet germicidal and other hostile invasions of the eye-coverings by a free supply of blood. To arrest this flow of nutri-

\*New York Medical Journal, May 16, 1896.

†The *Ophthalmoscope*.

tive fluids is to postpone or prevent a cure of the disease. Yet as local hemostatics and as adjuncts to eucaïne and cocaine, (*eucaipren*, *cocarenaline*, *caprenaline*), eserine, atropine, fluorescein, suprarenal derivatives have an important place in ophthalmic practice.

### **Venesection.**

#### *Phlebotomy. General Blood-letting.*

In the revulsion of feeling and the reversal of public and professional opinion this method of lessening *blood-pressure*, removing the volume of *toxic blood*, *reducing abnormal temperature* and of relieving the pain and *congestion of inflamed tissues* has almost been forgotten. In my opinion, there is still a place for this remedy, especially in cases of *acute iritis*, *acute inflammatory glaucoma*, *scleritis*, threatened *panophthalmitis* occurring in robust, full-blooded individuals that were benefited by "letting blood" in the good, old way. Webster Fox has voiced this sentiment quite recently (see *retinal hemorrhages*) and the ophthalmologist would do well to bear it in mind.

From four to 10 ounces of blood may be drawn from the upper arm and the venesection may be repeated if necessary.

It has been said that the American is not a fit subject for phlebotomy and it is quite true that the systemic and local effects of this form of depletion may usually be reached by *purgation*, *counterirritants* (q. v.) and such local lymphagogues as *dionin*, but there still remains a class of plethoric individuals in whom acute outbursts of inflammatory eye disease urgently call for more potent remedies.

Excepting in cases of extreme anemia, hemophilia, senile cachexia, Kyrieleis recommends venesection in relapsing ocular hemorrhages, and, if not successful, as a last refuge, ligature of the common carotid. However, he believes venesection has advantages over ligature: under aseptic precautions it is a perfectly harmless procedure and it may be repeated without damage as often as required.

### **Wines.**

#### *Vina. Medicated wines.*

Medicated wines form a class of liquid preparations in which *white wine is used as a menstruum*. They are all freely miscible in water and in alcohol and although quite similar to tinctures are not so strongly alcoholic. The ophthalmologist is mostly interested in *vinum opii* (q. v.).

### **X-Rays. Roentgen Rays.**

The remedial use of this agent in the treatment of eye diseases is of undoubted value, although there have not as yet been firmly established those rather extravagant claims that were first made for it. In *palpebral epithelioma* (Sweet, Pusey, Mayou) and *vernal conjunctivitis*

(Frank Allport) undoubted cures have been effected; in *sarcoma* and *carcinoma* of the ocular tissues it has been decidedly helpful.

Holzknacht has called attention to the difference between carcinoma and sarcoma, in their relation to X-rays. It is known that the action of the rays rapidly becomes less effective below the surface, apparently because the greater portion is absorbed by the superficial layers; cells of pathologic tissue are also much more sensitive to the rays than those of normal tissue. Carcinoma cells are only destroyed on the surface, while the deep infiltrating carcinomas of the skin are very little, and the carcinomas of internal organs are not at all affected by X-ray treatment; on the other hand, as shown by cases already reported, even deep-seated sarcomas, e. g., of the ovaries, react in a surprising way to the rays. The sarcomatous tissue is not alone in this respect; it shares the peculiarity of enormous sensitiveness with that of *mycosis fungoides*, and of *pseudoleukemia*. The action of the X-rays, therefore, depends not only on their penetrating power, and the absorbing power of the tissue treated, but also on the sensitiveness of the tissues exposed to their influence.

I invariably use this agent after every enucleation or orbital exenteration for malignant disease.

Birch-Hirschfield points out that unless the Roentgen rays are used with proper care they may occasion loss of the eyebrows and eyelashes, burns of the conjunctiva and conjunctivitis, and inflammation of the cornea and iris. Intraocular injuries may also follow, such as degeneration of the macular region and ganglionic layer and vessels of the retina, and of the medullary fibres of the optic nerve. He consequently suggests that the eyeball should be properly protected and that exposure to the rays should neither be too protracted nor too frequent.

The X-rays have been found effective in the treatment of rodent ulcer and epithelioma of the eyelids; sarcoma and other orbital growths; trachoma; tuberculosis of the conjunctiva; vernal catarrh; blastomycetes; scleritis; blepharitis; glaucoma.

# CHAPTER V.

## THE TECHNIQUE OF OPHTHALMIC THERAPY.

*Baths—Bier's Congestion Treatment—Local Blood-letting—Leeches—Wet Cupping—Brushing and Swabbing—Brossage—Cataphoresis—Cautery—Application of Cold—Dams—Application of Heat—Hot Water Bags—Irrigators—Undines—Hypodermic Injections—Intra-ocular Medication—Massage.*

### Artificial eyes.

*Protheses.* (See *Diseases of Orbit.*)

### Baths.

#### *Sweat Baths.*

The following directions I am in the habit of furnishing patients for home or hospital treatment:

The baths should be given when the stomach is empty. The patient should be in bed and *wrapped up to the chin in a woollen blanket* and again covered with at least four woollen blankets. Under the latter six quart bottles containing *boiling hot water* should be placed. If used at all, pilocarpine or other adjuvant should now be given by the mouth or hypodermically. The patient is also given to drink at least a pint of very hot water, very hot and weak lemonade, or very hot tea, to be administered through a bent glass tube, *while the patient is lying down*. In a few minutes he should begin to break out in a profuse perspiration, which should continue for at least two hours, only stopping short of that time if he shows any bad symptoms. At the end of two hours he should be thoroughly dried and the skin rubbed with alcohol and then allowed to rest for another two hours, when he may go out if he wishes.

### Bier's Congestion Treatment.

(See *Hyperemia Treatment.*)

### Blood-letting, Local.

*Local bleeding. Leeching. Wet cupping.*

It is generally agreed that the local abstraction of blood is a valuable agent for the reduction of most *acute, deep seated* inflammations of the eye, such as iritis, iridocyclitis, glaucoma, choroiditis, etc. The pressure exerted upon the sensitive nerve-endings by the dilated blood vessels (and increased quantity of blood in the congested tissues) is thereby removed and the severe pain which usually accom-



panies these abnormal conditions is often promptly relieved. Although there are several methods in use for the abstraction of blood in this neighborhood, such as scarification of the conjunctiva, opening an artery in the temple or the application of the *leech*, the last named is the most popular. One may use either the living animal or its substitute, the *artificial leech*. The latter is preferable, as it is *not only more certain in its action and more agreeable to the patient, but the amount of blood abstracted can be easily regulated.*

The *artificial leech* consists of a glass cylinder in which works a piston connected with a thumb screw. This is attached to the piston rod, by means of which it can be raised and lowered. *The skin of the temple, half an inch from the outer margin of the orbit, is the most desirable place for its application.* Here the skin is first scarified, either with a small instrument containing a punch that cuts two crescentic wounds, or a number of small incisions are made with a fine scalpel. The end of the cylinder is then applied over the wound and the blood withdrawn by exhausting the air in the cylinder. At least half an ounce of blood should be withdrawn if a decided effect is to be produced upon the intraocular circulation.

#### **Cupping.**

A rubber "cup," or a glass cylinder attached to one, and a small lancet are all that are needed for this operation. The skin of the temple is highly scarified by criss-cross incisions and the blood drawn by suction. The cup of the Victor or other machine, used in giving massage (q v.) may also be used. *Dry cupping* is occasionally recommended for the relief of ocular pain.

#### **Brushing and Swabbing.**

*Grattage. Brossage.*

The mechanical removal of diseased tissue from the conjunctiva with or without the application to the partially denuded area of anti-septic or other medication is an effective remedy in several diseases of the lids. In *trachoma*, for example, with exuberant folliculitis, the evulsion (after alypin or cocaine) of the granulations with the *thumb nail*, (rather barbarous method) with a *tooth-brush*, with *gauze on the end of a probe*, not to mention special forceps and other appliances invented for the purpose, is generally followed by excellent results. If applications are subsequently made it is well to wait until the bleeding (to which the beneficent results are in part due) has entirely stopped. Then gauze wrapped about a wooden spatula and dipped in the remedial agent [tincture of iodine, 1:3000 bichloride or cyanide of mercury, 1:2000 formalin, glycerite of tannin, etc.] is gently rubbed over the diseased membrane.



Swabbing without preliminary curetting, grattage, brossage, etc., is a valuable means of thoroughly applying many remedies, both liquid and solid. Cotton or gauze wrapped about wooden, glass or other applicators and dipped into the solution or fine powder forms an excellent means for these procedures.

*Camel hair pencils* though effective are less cleanly than this method, unless they are renewed at each application.

### **Cataphoresis.**

#### *Cataphoresis.*

Has been employed by Krückman (1) who used it for introducing mercury locally into the system in syphilitic diseases of the eye. He found, experimentally, that currents of 1.2 to 1.3 milliamperes could be applied to the eyeball without producing necrosis or any change in the finer tissues of the eye. Of the various salts of mercury, sublamin 1-3,000, and succinate of mercury, 1-4,000, were found to be the least irritating. The method is to be recommended only for rapid and temporary use, a general mercurial treatment being required at the same time. It may be used in the following syphilitic conditions: 1. In rapidly growing or early appearing nodular processes, e. g. tuberculous syphilide and gumma resembling episcleritis. 2. In obstinate inflammation when the body is already oversaturated with mercury. 3. For diagnostic purposes, when the general symptoms have not appeared, and it is important that they should not be masked. 4. For very rapid action. 5. In the presence of mercurial stomatitis.

It is applied by especially constructed electrodes which can be attached to the street current. A current of 0.8 to 1.0 milliampere is employed for 20 to 30 minutes, and the current is reversed every two and one-half to three minutes. The treatment may be repeated every other day, and from three to ten treatments are usually sufficient. The author reports 28 successful cases.

D. S. Sager (p. c.) believes, after cataphoresis, if the lower canaliculus is split, in washing out the sac. He makes it a point to turn the bent tip upwards, syringing so that the fluid, argyrol or other, regurgitates through the upper canaliculus, or at least so that the surrounding tissues shall be well medicated and cleansed. Where the upper canaliculus is slit open as advised by Landolt, the procedure is already solved. Then again in trachomatous and chronic granular conditions of the eyelid, he suggests that the cataphoretic treatment on the lids be given a fair trial. He has succeeded with it when radium, X-ray, Finsen, high frequency, etc., etc., have all failed. The method is accomplished by placing the positive end of a copper electrode in a solution of common salt, the negative electrode also in the

solution, with no contact of electrodes. When a sufficient amount of copper chloride is deposited upon the positive electrode, after wiping the lid clean with absorbent cotton, or washing off the lid surfaces, the positive electrode is applied directly to the lid-surface for a few seconds, even to half a minute. Sometimes the lid is cocainized or otherwise rendered insensible (holocaine or eucaine). The reaction is probably considerably less than with copper sulphate stick, this depending upon the individual somewhat. He used this same method in reducing turgid nasal conditions.

#### **Cautery.**

(See, also, *Cauterants*.)

*Instead of making actual contact* with the point of the cautery, D. W. Greene (p. c.) heats the metallic point to a *cherry-red color* and approaches it to within half a mm. of the corneal surface (or as near as possible without touching it) so as to destroy only the superficial debris. This method produces effective asepsis without destroying any normal tissue and no scarring results.

*Actual Cautery.* An excellent *substitute for the galvanocautery* is the hollow needle fashioned after the Paquelin cautery used in *pyrography*—"burnt wood" work. This simple device rarely gets out of order, can be had everywhere for a few dollars and, when the electrocautery is not at hand, will be found most useful; indeed, I know several surgeons who, for various reasons, have discarded all other forms of the actual cautery and use the "burnt wood" needle instead.

#### **Cold, Application of.**

Cold is a common and extremely useful application to the eye. The form of its application should depend upon the character and locality of the lesion. *Iced applications* are used in the severer forms of inflammation, when secretion is abundant, by means of gauze pads (7 or 8 thicknesses) or absorbent cotton about 2½ inches in diameter. These pads are placed on the flat and smooth surface of a block of ice, which should be large enough to hold at least half a dozen, and the excess water wrung out before applying them to the eye. They must be *moist but not wet*, in order to avoid the disagreeable chilling of the surface of skin from the water running over the face. The pad should be changed frequently and, as it quickly absorbs the heat from the inflamed parts, ought to be replaced by another pad with as little delay as possible, so that the eye will not be exposed any longer than absolutely necessary during the procedure.

In the less severe inflammations cold may be applied in a manner similar to that described under moist hot applications, by means of a

folded towel, using a basin of cold or iced water in place of the hot water. Cold or iced applications should not, as a rule, be used as long or as often as hot applications. In the milder forms of ocular inflammation five minutes is quite a sufficient length of time, although in the severe types of purulent conjunctivitis iced applications may be kept on for a longer period. Cold applications should not cause pain or discomfort to the eye; if they do they must be discontinued, or replaced by hot fomentations. The ice pack should never be applied to the eye.

Cold is generally employed in *superficial inflammations* of the eyeball and lids, especially in hyperemias and inflammations of the conjunctiva, purulent and otherwise, but is to be avoided when the cornea becomes affected. It is also indicated in most injuries of the globe.

A. Duane (p. c.) believes that iced applications should be used in (a) acute conjunctivitis, ophthalmia neonatorum (gonorrheal ophthalmia, traumatic conjunctivitis) as long as the lids are intensely swollen. Suspend the application when the skin of the lids begins to wrinkle, showing that edema is subsiding. Use it also (b) in traumatic iritis.

#### **Dams.**

##### *Immersion treatment.*

That the medicament may remain for as long a period as seems necessary when instilled into the conjunctival sac, several devices have been invented. Among these is the making of a dam to stretch from the nose along the orbital margin to or beyond the external canthus. The patient should lie on his back and the dam, made of rubber, clay or other material, retains the collyrium poured into the space thus fashioned until it overflows and thoroughly covers the front of the eye. Myles Standish, as well as other surgeons, employs this means for the application of argyrol and similar agents for periods varying from five minutes to half an hour. Additional effect is obtained by having the patient "wink" the fluid well into the eye during this time.

Aside from other treatment of inflammations of the lids, lachrymal apparatus and uveal tract, E. E. Holt (p. c.) uses a dam about the orbital margin, of putty, cotton batting or rubber cloth. The patient lies down, the cavity thus made is filled with hot normal salt solution, and the patient winks in the fluid until it becomes cool. This expedient facilitates the resolution of the inflammation, the exudates clear up and the parts are materially assisted in regaining their normal function.

**Heat, Application of.**

Heat in eye surgery is generally applied in the form of *moist applications*.

*Dry heat* is sometimes used, but its action does not seem to be as effectual in promoting the absorption of the products of ocular inflammation as the moist forms. Various appliances and methods of applying *dry heat* have been recommended, all possessing their advantages and disadvantages. A simple and easy plan is to take *an ordinary saucer and place it in the oven until it is too hot to handle*. It should then be wrapped in a piece of flannel, which has also been well heated, and applied over the eye and surrounding parts, previously filling in the depression around the eyeball with warm cotton wool. The whole dressing should then be kept in place by a bandage.

*The direct application of heat to the eye.*

Several workers have devised methods for applying heat directly to the eyeball. For example, Ostwalt\* has invented an appliance, called *Thermærophore*, which essentially consists of an elastic bulb, a spiral tube, and a soft rubber cup (with attached thermometer) large enough to fit over the orbit. Fresh air is driven by the bulb into the spiral tube, which is placed over a Bunsen burner, and the air heated by these means is then forced into the rubber cup. The dry, superheated air can be borne at a temperature of 100°, 150°, or 175° C. *Treatment, given once or, occasionally, twice a day, is continued for about half an hour*. The apparatus is intended to be used by the patient himself. Golesceano,\*\* on the other hand, attains a similar end by adopting a somewhat different plan. He applies heat to the eye by means of hot vapour. His apparatus consists of a dome-shaped boiler, connected with one branch of a double-channeled tube, of which the second branch is connected with a hand-bellows. Vapour from the boiler passes through the peripheral part of this tube, while cold air from the pump is forced through the central division. The vapour is led into a funnel-shaped mask fitted over the patient's orbit. The steam has a temperature of 40° to 45° C. Applications number one to four daily, and are continued on each occasion for from five to ten minutes. Ostwalt and Golesceano agree in finding the direct application of heat (dry or moist, as the case may be) useful in such superficial affections of the eye as *blepharitis, phlyctenular keratitis, interstitial keratitis, and various forms of iridocyclitis*. Roughly, then, the applications are indicated for the relief of pain and for the cure of

\**Annales d'Oculistique*, March, 1905.

\*\**Rccueil d'Ophthalmologie*, July and August, 1905.

chronic inflammations of the eyelids, cornea, or uveal tract. (Sydney Stephenson in the *Ophthalmoscope*, Aug., 1908).

The well-known Leiter's *coils*, made of lead tubing of a convenient size and supplied with tapes for application to the ocular region, are also quite effective as a means of supplying heat (or cold) to the eye. The reservoir is placed sufficiently above the level of the recumbent patient's face to permit of an easy trickle of water at the required temperature through the leaden coils to be received by a vessel placed beneath the bed or couch.

*Hot, moist applications* can be applied by means of pieces of flannel, or gauze, of several thicknesses wrung out of water as hot as can be comfortably borne. They should not be too large, although of sufficient size to completely cover the front of the eye. They should be changed quickly as soon as they show signs of becoming cool.

*Hot water* may also be applied with a small towel, or ordinary wash cloth, folded about three inches wide by eighteen inches long. The patient is directed to hold one end of the towel in each hand and, dipping it into water as hot as can be borne, to apply it to the closed lids and parts surrounding the eye. It is applied to the ocular region and held there a moment, the application being repeated for the length of time desired. *Hot applications to be of any therapeutic value should be applied every hour or two (depending upon the severity of the case) and for ten or fifteen minutes at a time. The temperature of the applications should be as high as can be endured, 115° to 125° F.* On account of the danger of scalding, the skin of the lids and surrounding parts should be protected by anointing it with vaseline, or some simple ointment, previous to making the application.

Hot applications are valuable in most deep-seated inflammations of the eyeball to promote the absorption of exudates, for the stimulation of the circulation and for the *relief of pain*. They are especially indicated in *ocular headache, iritis, cyclitis, keratitis and corneal ulcer*.

The Japanese "hot-box"—the small hand-warmer to be obtained in any of our "Oriental" art stores—is a favorite instrument for applying *dry heat* to the eye. It is readily obtained, quite effective and gives out a uniform supply of caloric for an hour or two.

A. Duane (p. c.) advises hot (not simply *warm*), moist compresses in all painful and inflamed conditions of the anterior portions of the eye except when cold (q. v.) seems indicated or is not well borne. In cases of uveitis, etc., he thinks it is advantageous to apply hot water directly to the eyeball, drop by drop, using a solution (saline

or boric acid) of 110°-145° F., or higher, as the patient develops tolerance.

### Hot Water Bags.

These are made of convenient size and shape for application to the ocular region. They afford one of the most cleanly means of applying dry heat and of securing rubefaction. When covered with flannel or wrapped in cloth they retain the heat much longer and are much less liable to produce burns. The possibility of this accident should always be kept in mind; the bag should not be used when it is too hot to be borne for half a minute against the cheek.

O. A. Griffin\* uses in aggravated and *prolonged acute inflammatory diseases of the eye* a small rubber bag through which either hot or cold water can be syphoned. To make the application more effective (by a retention of the applied temperature) a double layer of moistened gauze, about two inches square, is first placed over the affected eye and the water bag then put into position and retained in place, if desired, by means of a tape or string. Single or double bags are used, depending upon whether one or both eyes are affected. To retard the discharge of water and thus prolong the duration of application, and also to produce a distension of the bag, a tiny opening is made at the end of the discharging tube by inserting a bit of hard rubber tubing which contains a minute passage through which the water escapes. The arrangement is completed by placing two pitchers of like capacity at the proper height to produce a slow and steady flow of water from the upper to the lower vessel. When the upper one is nearly empty, it is only necessary to pinch the tubing or elevate the discharging end and pour the water from the lower into the upper pitcher to keep the apparatus running properly. The stream will flow from thirty to sixty minutes, depending upon the relative height of the pitchers and the size of opening in the discharging tube. By timing the process, the attendant may know exactly when to change the water, and the compress may be applied steadily and indefinitely without disturbing the eye or the patient, which is very important, especially when the patient is sleeping and rest is essential.

If *cold compresses are desired*, pieces of ice are added to the water, and to retain the rubber tubing in the upper vessel a foot of glass tubing is inserted into the rubber one, which also prevents collapse of the tubing should the ice press upon it.

If *hot applications are indicated*, heated water is used instead and kept at a uniform degree by occasional additions of hot water. In his experience, unless pain demands a continuous application, the

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\*Trans. Am. Acad. of Oph., p. 140, 1906.



most satisfactory results are secured when the compress is employed intermittently, fifteen or thirty minutes elapsing between applications.

After the apparatus is properly arranged, the appliances for which may be obtained in any ordinary home, it requires little or no attention and, in his opinion, is the most rational method of employing heat or cold in the treatment of acute inflammatory disorders of the eye, inasmuch as the temperature is uniform, the water bag is light and conforms to the surface beneath, the compress is applied directly to the area desired, the patient is not chilled or drenched by escaping water, and the application may be used indefinitely without disturbing the patient. The apparatus is made by F. A. Hardy & Co., Chicago.

#### **Heat, Electric.**

In these days of the universal employment of electric lighting this forms one of the most valuable sources of *thermal treatment*. A very good method of using it is that described by Maddox (20). He uses a half to seven-tenths ampere current passed through a very fine wire which is wrapped around a roll of cotton flannel. The current can be taken from an ordinary lighting wire and controlled by a transformer. The employment of dry heat he believes is especially indicated in rheumatic affections of the eye and in certain forms of glaucoma. The indications for the use of dionin are still unsettled. As a rule the drug should be employed when heat is indicated, while adrenalin is useful when cold is the more applicable. I exhibited at one of the meetings of the Ophthalmic Section of the American Medical Association an *electric hat-iron*, which is used in the manner suggested by Maddox. This appliance can be purchased at most dealers in electric supplies and is a handy and effective means of applying dry heat to the ocular region.

#### **Hyperemia Treatment.**

##### *Bier's congestion method.*

This therapeutic measure has not, especially in ocular diseases, proved to be unusually valuable, but many observers have recommended it in most *chronic diseases of the lids and anterior eye segment*. I have employed for the purpose of obtaining ocular hyperemia both the Pyncheon pump and the Victor suction apparatus and believe it has a place in ocular treatment.

Hoppe, (*Münch. med. Wochenschrift*, Oct. 2, 1906),\* uses an apparatus that consists of a *small glass cup, rubber bulb and manometer*. Applied to the closed lids of a normal eye, a 30 mm. mercury pressure produces *hyperemia and serous infiltration of the skin and*

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\*From the abstract in the *Annals of Ophthalmology*.



*tarsal conjunctiva*, the lids becoming of a violent hue. The congestion is the result of venous obstruction. The reaction is more marked when the lids are away from the eyeball. Lachrymation then becomes more intense, the secretion being of a sero-muco-sanguinous nature. The contents of the Meibomian tubules and goblet cells may also be expelled, although the bulbar and episcleral veins show no changes.

The marks of congestion disappear after removing the instrument. Conjunctival and cutaneous hemorrhages may occur, but only after exposing the lids to higher pressures. In such instances the lids may be discolored several days. Thirty to forty mm. pressures cause no pain. No disturbance of vision was noted.

Thirty cases of ocular disease were studied under the influence of the congestion apparatus. Six were chronic and three acute cases of purulent inflammation of the Meibomian glands, one chronic blepharo-conjunctival ulcer, one chronic hyperemia and thickening of the lid margin, two furuncles of the eyebrow, and one cold glandular abscess. The other cases included stytes of various sizes and in various stages.

Treatment proved to be very satisfactory. Relief from pain was prompt, enabling the patient to attend to his occupation between treatments. Incipient inflammatory processes were checked, advanced conditions speedily regressed, often with the expulsion of a purulent core. Chalazia were less easily influenced by this treatment. Where pus had already formed, he did not hesitate to make small incisions before applying the instrument.

Thirty to forty millimeter pressures applied fifteen to thirty minutes at a time, two or three times daily, usually suffice. This method, he contends, should not be considered the only form of treatment but rather an additional remedy at our command; often used to best advantage in conjunction with other therapeutic measures. The apparatus should always be used by the physician himself.

#### **Hypodermic Injections.**

Although the hypodermatic use of drugs in eye diseases does not differ in its technique from the same method employed as a part of the general treatment, yet the ophthalmic surgeon should be impressed with the remarkable efficacy of this kind of medication. Especially in the use of powerful drugs like *strychnia*, *cocaine*, *brucine*, *the mercury cyanides and iodides*, *atropia*, *pilocarpine*, *thiosinamine*, *morphia*, *enesol*, etc., the ophthalmologist should exercise the greatest care in performing this apparently simple operation. They generally exert their influence on the eye through the general organism and as such

are probably no more effective when given in the temple than in the gluteal region.

It may be necessary to use hypodermics for several weeks or months at a time, and we should remember that everything connected with them should be conducted with special reference to accurate dosage and asepticism.

Whether the injections be given for their local effect, e. g., for anesthetic purposes (in the removal of *chulazion*, *expression of granulations* or as deep, massive intramuscular medication) the results will to a large extent depend upon an accurate dosage and care in making the injections. When possible, superficial veins and nerves should be avoided, the needle should be very sharp and as small as possible, and successive injections should not be given within the same area or, for that matter, upon the same limb. When a solution of cocaine is injected deeply into the muscular tissue it largely passes into the general circulation and is lost so far as local action is concerned.

This is the reason for the combined use of a vasoconstrictor and a local anesthetic. The injection, especially after the Schleich method, of the solution of a suprarenal alkaloid brings about a local vasoconstriction that in turn prevents the too rapid absorption of the cocain solution into the general circulation, and also prevents, for the time being, the hemorrhage that is so objectionable in ophthalmic operations.

Lanceraux\* has reported a case of *aneurism of the ophthalmic artery* cured by deep orbital injections of *gelatine*. He had exophthalmus, diplopia, headache and a rumbling noise in the head; the latter symptom left off entirely two hours after the first injection of *gelatine*, reappearing seven hours later and disappeared again after renewing the injection. The tinnitus returned with diminished intensity after the effect of each *gelatine* injection had passed off. After thirty-nine injections it altogether disappeared, the aneurism having completely filled with blood clot.

In *retinal hemorrhage* Wuillomenet,\*\* in addition to other remedies, prescribes subconjunctival injections of sterile, 2 per cent. solution of *gelatine* with successful results.

Sydney Stephenson (*Ophthalmology*, Oct., 1908) gives the following review of the employment of *injections of alcohol* for the cure of *angioma of the conjunctiva* and *blepharospasm*.

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\*Lancereaux, *Medizinische Klinik*, 1907, p. 370.

\*\*Wuillomenet, *Ophthalmology*, Oct., 1907; *Annales de la policlinique de Paris*, 1907, November.

H. Gifford\* cured an angioma, one-fourth inch thick, extending from the caruncle to the fornices and cornea, but not invading the palpebral conjunctiva or the skin, by injecting on several occasions two or three drops of absolute alcohol into the substance of the tumor.

In the course of 1905 Valude\*\* reported the instantaneous cure of two cases of *tic non-douloureux* by injection over the stylo-mastoid foramen of 1.5 cc. of 80 per cent. alcohol with a little added cocaine. One injection only was employed in each instance. The injection, as usual, was followed by temporary facial paralysis. In one of Valude's patients the spasm had lasted for three and the other for ten years. Abadie and Dutemps\*\*\* reported a successful case in a woman of 56 years, in whom unilateral facial spasm had persisted for sixteen years, and for five years had been so severe that she had been compelled to give up her occupation, that of a dressmaker. de Speville† reported the cure of hemifacial spasm in a woman, aged 62, after the injection of 1 cc. of 80 per cent. alcohol with 1 cc. of stovaine. Noceti‡ treated with success three cases of clonic hemi-spasm by the injection of from 1 cc. to 1.5 cc. of 80 per cent alcohol, containing from 1 cc. to 1.5 cc. of cocaine hydrochloride. The injections numbered two and three. Valude†† has recently reported three cases of *blepharospasm* cured by alcohol injections and has taken the opportunity to discuss the question of the treatment of the condition by alcohol. Valude has now replaced the cocaine, used formerly, by stovaine. One cc. or 1.5 cc. is the proper amount of the liquid to inject, and the point of the needle should be moved gently to and fro while the fluid is being injected in the neighborhood of the exit of the facial nerve from the stylo-mastoid foramen. (See, also, *Subconjunctival and Intravenous Injections*).

#### Intraocular Medication.

In 1887-8 Abadie and Galezowski injected a solution of mercuric chloride into the vitreous, hoping to disinfect the bulbar region by bringing a powerful germicide in actual contact with the infected area. Although the results of this experiment were not favorable, other attempts, with *weaker solutions of sublimate, cyanide of mercury, argyrol, iodoform emulsion*, etc., have proved more successful. Haab, as is well known, has published encouraging reports of his method of introducing rods and discs of iodoform (q. v.) in substance

\**Ophthalmic Record*, Dec., 1906.

\*\**Annales d'Oculistique*, Dec., 1905.

\*\*\**Archives d'Ophthalmologie*, Feb., 1906.

†*La Clinique Ophthalmologique*, May 10, 1906.

‡*Archives d'Ophthalmologie*, Nov., 1907.

††*Annales d'Oculistique*, April, 1908.

into the ocular interior, especially to combat infected penetrating wounds of the cornea and bacterial invasions of the uveal tract and vitreous.

H. V. Wurdemann (p. c.) introduces 50 per cent. argyrol solutions into the anterior chamber through corneal incisions or wounds and has thereby saved many eyes with *hypopyon iritis*.

Intraocular injections of air, previously sterilized by passing it through a hypodermic needle heated redhot in an alcohol flame, have been used (Koster and others) for the treatment of *tubercle of the iris* and of other parts of the uveal tract. This is done on the assumption that it is the exposure of tubercular deposits in other cavities to the external atmosphere that occasionally results in cure or decided improvement. Unfortunately, however, this procedure has not met with much success in the eye and one now hears little of it.

### Intravenous Injections.

The injection directly into a *superficial vein* of the upper arm of various soluble salts for the purpose of obtaining a more rapid or more pronounced remedial result in eye diseases has been highly recommended by several surgeons of repute—notably by members of the French School of Medicine. The following estimate by Darier (*Thérapeutique Oculaire*) of this kind of medication is well worth our consideration.

Injection of the *soluble salts of mercury, and particularly of the cyanide*, is a difficult procedure, but in skilled hands has advantages of the first order, i. e., *absence of pain; rapid and exact action; no local lesions* (infiltrations, etc.) so often following intramuscular injections and no serious sequels.

The solution should be thoroughly aseptic, and contain no *cocain* or any other *analgesic*, as these act violently on the heart and nervous centers. The solution he recommends is as follows:

℞	
Hydrarg. cyanid.	0.33
Sod. chlorid.	0.08
Sod. phosphat.	0.07
Aquæ dest, et steril.	100.00

Two or three c. c. are to be injected into one of the veins at the bend of the elbow, taking care to give the injection slowly.

The technic is simple; less simple than hypodermic injections. There are persons in whom the veins are difficult to find. In these cases it will be necessary to have recourse to subcutaneous or intramuscular injections.

Proceed as for a phlebotomy, when one applies one or two turns of

a bandage tightly around the arm above the biceps. During the venous stasis, wash the site of the injection with cotton soaked in chloroform, alcohol or sublimate. Pass a fine platinum needle with iridium point through a flame; then introduce it cautiously into the vein. Before injecting aspirate slightly to see if the blood can be drawn into the syringe. If blood appears in the syringe one can be sure that a false passage has not been made. The bandage is then released, and nothing remains but to slowly (4 or 5 seconds) push the liquid into the vein. The patient complains at most of a sensation of chilliness; or occasionally of a taste of almonds. The needle is to be withdrawn quickly, and slight compression made with a tampon of cotton over the puncture. A drop of collodion will then seal the orifice.

Make the injections in each arm alternately so as not to weaken the vein, which after a great number of punctures will thicken, and at that spot become painful to further injections. This is the chief objection that has been made to intravenous medication, but it is always time to return to the hypodermic plan when the venous method does not permit the continuance of the treatment.

Nervous patients have, the first time, some apprehension, especially if the injection is made too rapidly or if it seems to them that the physician is not sure of himself, but such drawbacks are entirely compensated by the advantages of intravenous injections.

In using cyanide of mercury, one should not neglect before each new injection to ask of the patient if he has experienced since the last injection any colic, or diarrhea. In either event the dose should be diminished or the injections made less frequently.

After the first series of thirty injections they should be discontinued for a month; then resume with a second series, and even a third. Sometimes, in certain chronic affections like *keratitis parenchymatosa*, *choroiditis* and *irido-choroiditis*, one may be obliged to give, in the course of two or three years, from one to two hundred injections.

Darier has given thousands of intravenous injections, without complication, except occasionally a slight periphlebitis, where a little of the liquid has escaped outside of the vein. The entrance of air bubbles into the veins of the arm is without danger; he has injected a syringe full of air without inconvenience.

Complications are exceedingly rare. An infectious phlebitis has never, Darier maintains, been observed and it is hardly possible if the needle has been previously heated. He has found it well, *to prevent the rapid tolerance established by the organism to any one medicinal agent*, either to vary the mode of application (*inunctions, hypodermic injections, deep injections, sub-conjunctival injections*), or to change

the salt. Thus he makes a first series of twenty to forty intravenous injections of the cyanide of mercury; then allows three months of rest; then he gives a new series with the biniodide (0.01 increasing gradually to 0.03). If a third series is necessary, and we have to deal with one of those forms of tertiary syphilis with intractable cutaneous complications, or bony lesions, he has recourse to another salt of mercury, *enesol* (q. v.) for example.

This *salicylarsenate of mercury* is very soluble, rapidly eliminated by the urine, is seventy times less toxic than the biniodide, and is employed for injection in a 3 per cent. solution. It causes little pain.

A centigramme of *enesol* is equal to 0.0087 of the biniodide. A cubic centimeter of the 3 per cent. solution contains 0.0115 of metallic mercury, corresponding to 0.026 of the biniodide.

He has given intravenous injections of *enesol* of one to two cc. with most favorable therapeutic results, and has also employed it in *subconjunctival injections* frequently without provoking the least ocular or intestinal irritation. It may cause slight soreness of the gums after ten days of treatment.

In *sub-conjunctival injections*, *enesol* is less painful than the cyanide, while in *hypodermic injections* it looks as if it will replace all known salts requiring as an adjunct an analgesic of some sort; cocaine, acocin, or subcutin (q. v.).

*Sodic salicylate*. The intravenous use of the mercurial salts rendered Darier such service, that after reading the essay of Mendel, he did not hesitate to administer the salicylate of sodium by the same method.

This salt he employed in *iritis*, *episcleritis* and other *rheumatic affections of the eye*, 0.50 to 0.60 daily into one of the veins at the elbow. With these doses of 0.60 as the maximum, he obtained better results than with three or four grammes of the *salicylate* or *aspirin* given internally.

Credé has demonstrated the bactericidal power of *collargol* (q. v.) in affections caused by streptococci, staphylococci, etc. He utilized it in intravenous injections of 0.08 to 0.12 centigr. of a 2 per cent. solution, in many infectious conditions with excellent results and Darier now holds with Credé that this mode of application by intravenous injection is the only true way.

DeLapersonne has treated by means of intravenous injections of collargol, certain forms of *purulent iritis due to systemic infections*. In one case the hypopyon completely disappeared, and the case was cured by a single injection.

In traumatic cases, equally good results are obtained by collargol,



but if panophthalmitis has been once established of course nothing can stop it.

### **Irrigators.**

#### *Undines.*

Numerous appliances for *flushing the conjunctival sac*, irrigating the bulbar surface and washing out post-operative and other cavities, are known to the ophthalmologist. In addition to various kinds of *medicine droppers* (q. v.) the common glass or rubber bag irrigator is a valuable means of conjunctival, corneal and orbital cleansing. The glass reservoir containing the *irrigating fluid* (q. v.), usually warmed to 100° to 110° F., is held from 1 to 12 inches above the eye, according to the needs of the particular occasion, the force of the stream and the amount of escaping fluid being regulated by a stop-cock, the thumb and finger or by some special appliance. All the purposes of ordinary detergent flushing can be attained by raising the bottom of the reservoir a few inches above the level of the eyeball. The hydraulic force thus utilized is, as a rule, sufficient for complete cleansing of the parts.

*Undines* (in the shape of miniature glass retorts) are also useful devices for flushing the eye.

The ordinary *Florence flask*, fitted with a rubber cork through which pass two glass tubes, one for the entrance of air, the other for the exit of the irrigating fluid, is used for conjunctival flushing in some hospitals.

A glass tube, six inches long, with rounded ends, one fitting into a *soft bulb holding two to four ounces* of fluid, furnishes an excellent means of conjunctival cleansing.

*Irrigators for washing out the anterior chamber* after cataract extraction, in hypopyon, after penetrating wounds, etc., are of varied construction. Lippincott (See *After Treatment of Cataract Extraction*) and others have devised ingenious apparatus of the kind that act with great satisfaction. Several special syringes are also used for the same purpose.

I occasionally employ a glass tube bent at an obtuse angle and terminated in a flat, rounded end about 3 mm. wide. This tube, inserted into a soft rubber bulb holding 2 ounces of water, will be found a simple, effective and easily controlled anterior-chamber irrigator.

All these appliances should be capable of sterilization and should be kept perfectly dust-free. Irrigators with soft-rubber tubing or bulbs should be inspected before using to see that they harbor no particles of detached rubber, zinc oxide, chalk or other ingredients that the economical manufacturer is wont to add to the rubber itself.

Finally, I wish to enter a protest against irrigation with cotton



dipped into the detergent fluid, inasmuch as minute fibrils of the former are very likely to find lodgment in the sac, on a roughened cornea or, worst of all, between the lips of wounds in the anterior segment of the eye.

#### **Massage of the Lids and Eyeball.**

This is valuable in *most chronic diseases of the lid borders and substance, in many subacute and chronic diseases of the conjunctivæ, and in the repair stages of a large proportion of ulcers and deposits in the cornea.* It is also employed for the temporary reduction of the increased tension of glaucoma. It is contraindicated in all conditions in which its use is followed by much injection of the eyeball, photophobia or lachrymation.

Massage may be applied alone but is best used in conjunction with some oily remedy, or ointment, which should be made perfectly smooth and of such a consistency that it is readily distributed over the conjunctival and bulbar surfaces. (See *Brown Ointment.*) It is best applied with the pulp of the finger placed on the skin of the lid. The patient is told to *look down in massaging the upper lid* and upper portion of the eyeball, and *up in treating the lower lid* and lower portion of the eyeball. In each instance the other lid should be drawn away from the one undergoing massage.

*If the cornea is to be treated the patient should be directed to look straight forward.* The finger movements should be fairly rapid, and made at first in a circular fashion about the cornea as a center; then they ought to radiate from the pupil to the bulbar equator in all directions. In no instance should they exert undue pressure upon the eyeball. *The duration of the seances must not be more than three or four minutes each,* and their frequency will vary from once daily to three or four times a week. The application should never produce severe pain or other marked discomfort, although this remedy usually causes a temporary congestion of the conjunctival vessels and a slight "foreign body" sensation, both of which should pass off within half an hour after the application.

The *value of this remedial measure* consists in emptying the palpebral ducts (meibomian and sudoriparous) as well as the blood and lymphatic vessels situated around the sclero-corneal margin and the lymph spaces in the cornea, thereby promoting absorption of any exudates that may be present. At the same time the blood vessels are still further stimulated to contraction by irritation of the vasomotor system.

Calvin R. Elwood (p. c.) has found it of great service in *chronic*

*conjunctivitis*. He feels that there is no question about the stimulation of the ocular lymphatic circulation, with consequent elimination of waste products.

Elschnig has found *massage* very useful in chronic trachoma with thickened tarsus, marked pannus or progressive ulcerations of the cornea that resists other methods of treatment. It is also of value in the recurrent keratitis of trachoma. He employs a *probe armed with cotton* which is *dipped into a solution of oxycyanide of mercury* (1:4000) and introduced beneath the eyelid, the latter being mediate-ly pressed against the forefinger of the other hand held against the outer surface of the lid. The probe is rubbed firmly back and forth against the palpebral conjunctiva. A 2 per cent. solution of cocain is used for the first two or three sittings, after which no anesthesia is needed. An ice-bag must be used immediately after the massage. At first this is carried out every day, then every two or three days, the duration of each sitting for each eye being five minutes. In conjunction with other methods of treatment massage is useful in most external diseases of the eye (except *acute* trachoma), particularly in all forms of chronic conjunctivitis, when these are associated with hypersecretion or with retention of secretion in the Meibomian glands, in phlyctenular conjunctivitis, spring catarrh, small chalazion, and in certain chronic diseases of the iris and even of the choroid.

In an article on this subject I have already stated that I prefer *simple massage with the tip of the finger* to any form of the instrumental variety, such as direct rubbing with pieces of cotton wool, tetanization, the use of sounds and other devices. The sitting should rarely exceed three or four minutes and the best application for the purpose of *pure* massage is a drop or two of cod liver oil, or pure castor oil. I prefer for disinfectant or stimulating medication mercurials of various strengths combined with oleaginous excipients, such as the citrine ointment diluted with brown cod liver oil. (See *Brown Ointment*.) At the end of, or during the massage, combinations of the remedy with the ocular secretions, especially mucus, should be coaxed out of the sac by means of small pieces of damp cotton and the stroking movement resumed until nothing further comes away. I find the most satisfactory employment of massage in chronic diseases of the lid-borders and substance, in almost all the sub-acute and chronic forms of conjunctivitis, in most forms of ulcer of and deposits in the cornea, for the temporary relief of glaucoma and in some forms of retinal embolism. I believe it is useless or harmful in the early stages of acute conjunctivitis and keratitis, in most forms of true trachoma, spring catarrh, disease of the iris, ciliary body, lens, choroid, vitreous, or optic nerve.

Maklakof uses the Edison spring modified for purposes of massage, the treatment lasting from five to ten minutes, the ball of the apparatus touching the eye directly. Various observers furnish contradictory reports of the good and bad results obtained from its use; most of these are favorable, especially where the treatment is employed in suitable cases; for example, Corcashvili reports four cases of episcleritis in which the results were very good.

Darier (*Thérapeutique Oculaire*, p. 21) advises for finger massage *mercurial lanoline*. This is a preparation put up by Paris druggists in gelatine capsules, each containing four grammes. He believes that the preparation undergoes slighter alterations and is more easily absorbed than similar preparations of mercury.

In this connection Darier believes that digital massage should always be carried out under the immediate supervision of or, better, by the surgeon himself. Otherwise it is likely to be useless or harmful.

Vacher uses for the same purpose what he calls *compound gray oil*. This, Darier says, has about the same formula as his mercurial lanoline.

Stephenson advises the use of a one per cent. ointment of the subacetate of lead in follicular conjunctivitis (q. v.). A small piece is applied to the everted conjunctiva once a day. After two weeks' time the strength of the ointment is doubled, the application being followed by massage. Under this treatment the hyperemia disappears, the discharge is less, the follicles become reduced in size and eventually disappear.

*Vibratory Massage.* Leartus Connor (p. c.) is in favor of this method and has obtained definite effects from its use. It *reduces the tension of the eye-ball*, improves intraocular circulation and increases the activity of all the living cells in the uveal tract. It frequently improves defective vision when other remedies have failed.

Domec\* uses an elliptical eye-cup with concave margins to fit snugly about the globe. He exhausts the air with each inspiration of the patient, exercising 50-200 tractions at a sitting. In *nervous asthenopia*, in glaucoma and infectious cases associated with severe pain this method relieved the pain. It can be employed as a preliminary measure to pressure massage or as a substitute for the latter. The analgesic action he attributes to traction on the ciliary nerves.

#### **Photo-therapy.**

I quote almost verbatim the review by Sydney Stephenson (*Ophthalmoscope*, Oct., 1908) on *ocular photo-therapy*. L. Koch† obtained

\**Oph. Klinik*, No. 22, 1906.

†*Münch. Med. Wochenschr.*, Sept. 18, 1906.

good results in nineteen cases of keratitis, of *serous iritis* and of *corneal scars* by exposing the eye twice a day for about five seconds to the light of a 20 candle-power *electric lamp*. Frank's experiences with the *chemical rays of light* in various forms of *keratitis* were encouraging. He used the voltaic lamp of which the heat rays were arrested by passing the light through a saturated solution of copper sulphate. The eye was placed at the focal distance of a convex lens, by means of which the rays were concentrated.

D. E. Sulzer\*\* attempted to remove opacities of the cornea by exposure of the eye to the radiations from an arc-lamp. The eye was placed at the conjugate focus of the arc-light formed by a quartz lens, which had a diameter of 40 mm. and a principal focal distance of 50 mm. The exposure varied from 20 to 90 seconds, but essentially depended upon the reactional susceptibility of the patient. Reaction was proportional to the length of exposure to the actinic rays. It supervened in from two hours to two days after treatment under the guise of redness of the eye, lachrymation, and lancinating pains. Sulzer found that interstitial scleroses of the cornea improved. He made the important observation that under the influence of the treatment, tension falls, pupillary exudations become absorbed, and posterior synechiæ undergo rupture. Nineteen cases were quoted in support of Sulzer's conclusions.

Hertel\* has given much attention to the treatment of *ulcer serpens corneæ* (hypopyon-keratitis) by that means. Of 547 cases experimented on, 26 were cured with the light rays, derived from a kind of modified Finsen lamp and an amalgam of cadmium and zinc, with an arc of 3 mm. to 4 mm. at 2.5 amperes. Exposure ranged from three to five minutes, and, as a rule, several sittings were required. Reaction was pronounced. It was noted, and the point is practically important, that the resultant scarring was very slight after the treatment of hypopyon-keratitis by irradiation.

*Finsen Lamp. Finsen Light.*

The *concentrated light* produced by this lamp is (*Extra Pharmacopeia*) *violet and ultra-violet*. It is produced by an arc lamp in which the heat rays are cut off. Finsen's original lamp has been improved, and is known as the "Finsen-Reyn" lamp. It is portable, suitable for one patient at a time, and Finsen acknowledges its efficacy.

Fluorescent substances, e. g., *aesculin* (5 minims of a 5 per cent

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\*\**Annales d'Oculistique*, Nov., 1906.

\**Graefe's Archiv f. Ophthalmologie*, July 16, 1907.

solution) injected immediately beneath the skin to be treated are sometimes used as adjuvants.

Finsen recorded 800 cases of *lupus* more or less successfully treated in various parts of the body.

The rays obtained from carbon electrodes are more effective than those given off by iron ones. The current used in the lamp has a strength of 40 to 80 amperes and an electromotive force of from 45 to 50 volts. Rock-crystal lenses are employed which allow of the complete passage of the ultra-violet light.

Trachoma, chronic, simple granular lids and many other eye diseases have been reported as cured or improved by this agent but I have not been able, after a fair trial, to corroborate this evidence.

## CHAPTER VI.

### ADDITIONAL MEANS OF APPLYING OPHTHALMIC REMEDIES.

*Medicine Droppers—Ampullae—Irrigation of the Conjunctival Sac—  
Eye-Cups—Protective Glasses—Goggles — Eye-shades — Eye-rods—  
Cartons—Bandages—Chartae—Collapsible Tubes—Gelatine Discs—  
Ophthalmic Discs—Pencils — Points—Sprays — Soloids—Solubes—  
Sterules—Tablets—Triturates—Tabloids.*

#### Medicine Droppers.

*To apply solutions to the eyeball with a medicine dropper* (q. v.) let the patient lie down, or, sitting up, hold his head slightly tilted to the right (to medicate or cleanse the left eye, to the left for the right eye) and slowly drop about ten drops of the solution upon the closed lids. A pool of the mixture will form at the inner canthus and gradually overflow into and bathe the eye from that point when the lids are opened. In this way the patient experiences no discomfort and will be able to rotate the eye-ball in all directions so that the irrigating fluid comes in contact with the whole surface.

For the purpose of making (from discs, compressed tablets, etc.) fresh solutions and preserving them from dust and other contamination, Parke, Davis & Co., have prepared a medicine bottle and dropper, consisting of a graduated bottle with a capacity of 4 drachms of liquid. The tablets may be dissolved in the necessary amount of water, and the bottle closed by a pipette of improved form, the ground sides of which fit into the neck of the bottle as a stopper, the whole forming an air-tight container. The pipette is closed at the top by means of a rubber diaphragm which, when pressed down and then released, will cause some of the solution to ascend the tube. By again gently pressing the diaphragm, one or more drops can be easily forced out.

*Chalk's bottles* (England) have a rubber cap on a hollow stopper and may be either of clear or amber glass for eyewaters and similar lotions. They are often surrounded with metal cases that may be sterilized and are durable and suitable for traveling.

A very convenient form of eye-dropper is a *test-tube with a spout* half way up the side of it. In this eyedrops may be warmed if desired and by simply inclining the tube the patient can instill the drops into his own eye. By plugging the point-end with sterile wool a solution may be kept sterile.

*Single drops are instilled with best results* by forming a drop at the end of the pipette and simply touching the edge of either lid with it. If the remedy, eserine or atropine, for instance, is to chiefly affect the internal eye, the method of instillation should be different. In that case the upper lid-edge should be drawn away from the globe—the patient looking down—and the single drop applied to the raised margin beneath the eyelashes. The watery solution flows over the upper palpebral surface to the upper sulcus, thence over the globe surface to the lower cul-de-sac, by which time it has been evenly distributed over the largest possible absorbing area, leaving little or none to flow through the puncta into the nose.

This consideration is of some importance when powerful remedies like duboisine, eserine, hyoscine, cocaine, atropine, etc., are employed for long periods or in strong doses and one is desirous of avoiding their constitutional or toxic effects, or where, as in the case of homatropine and other expensive remedies, the fullest effect is required from the smallest dose or weakest solution. In both instances this plan serves to promote complete absorption and the *maximum local effect* of the instillation.

In many cases of sensitive eyes or still more sensitive patients who complain that a collyrium irritates, the *eyewater should be warmed*. As it is not feasible to warm the bottle each time drops out of it are to be used, the *medicine dropper may be completely filled with very hot water*, then emptied and a few drops of the collyrium drawn up into the pipette. The heat of the glass will be sufficient to warm the eyewater, when it should be immediately instilled.

*To insure slow and complete absorption of remedies* it is a good plan to dissolve them in, or mix them with, some oily or fatty menstruum (q. v.), such as olive, almond or castor oil, vaselin, lard, etc. These oily solutions and ointments form most valuable applications in chronic diseases of the eye.

*Irrigation of the conjunctival sac* and the anterior surface of the globe for sterilizing these and for the removal of discharge and other accumulations, is accomplished by means of weak solutions of any one of the antiseptics (q. v.) used in ocular therapeutics, e. g., bichlorid of mercury (1-10000), normal salt solution, boric acid, borate of soda (4 per cent.), formalin, 1:5000, or sterilized water. The lavage should be copious, and *is most effective when the solution is warm*.

Of the many appliances at our command one of the most useful for the purposes of irrigation is the *undine*, although an ordinary *fountain syringe*, the usual hospital *irrigator* or a *rubber tube syphon*, will serve every purpose. Care should be taken that the stream of



*water which strikes the eye should not come with too much force and that the end of the pipette should not touch the cornea, or anterior portion of the eyeball, lest these parts be injured. Thorough flushing of the parts rather than the employment of force is the object of irrigation.* The nozzle of the irrigating apparatus (*the glass pipette of a large medicine dropper acts admirably*) should, consequently, *not* be directed at the globe; it ought to be held nearly parallel with the lid edges.

*In irrigating the upper sulcus and upper aspect of the globe the patient looks down while the upper lid is gently drawn away from the eyeball.* This exposes the upper cul-de-sac to the cleansing action of the irrigating stream. To *cleanse the lower sac* the patient looks up, while the surgeon draws down the lower lid. The stream in most cases should be directed towards the inner canthus and not allowed to fall directly on the eyeball. If this precaution is not taken the patient will invariably resist, by closing the lids tightly, and difficulty will be experienced in effecting a thorough irrigation.

#### **Ampullae.**

Specially constructed glass bottles, hermetically sealed, to contain liquids likely to be injured by contact with the air or light. Generally they are opened by breaking their slim neck at a file mark in the glass.

#### **Eye-Cups.**

The ordinary *eye-cup* is a useful means of washing out the conjunctival sac. In using it the cup should be half filled with the irrigating fluid, then fitted snugly about the margin of the orbit. The head should now be tilted back, or the patient lie down, the previously closed eye opened and the liquid allowed to flow into the sac. Now open and close the eye slowly half a dozen times so that the irrigating fluid may come directly in contact with all the parts in and about the sac. Shut the eye, remove the cup and keep the lids closed for a few minutes.

H. C. Fenton (p. c.) believes that instead of using the ordinary cleansing collyria, that are likely to decompose, it is preferable in all cases to direct the patient to dissolve one-fourth teaspoonful of pure crystalline boracic acid in one-fourth glass of hot water and used with an eye-cup. This avoids the manifold dangers of dirty droppers and contaminated solutions.

#### **Eye Shades.**

Eye shades are sold in a variety of shapes, colors and sizes. The Extra Pharmacopeia divides them into the following classes (Great Britain): 1. Card covered with silk, flat or concave, suitable for either

eye. 2. Celluloid, flesh color, for right or left eye, or suitable for either eye. 3. Of pith, the "symétrique." 4. Straw, plaited, in three sizes. 5. Double eye shades, card, pith and celluloid.

*Goggles* and other forms of protective glasses (plain and tinted), *eye-shades*, *dressings* and *bandages* are used to guard against such outside influences (infective matter, wind, dust, strong artificial or natural lights, smoke) as are likely to irritate an inflamed or congested eye, or one that has been injured or operated on.

*Rest of the eye* is most effectually accomplished by paralyzing the accommodation with such cycloplegics as atropin, hyoscyamin, homatropin, and the wearing of tinted glasses, of which "London smoke" greenish and amber tinted coquilles are generally the best. This ocular "rest cure" may also be accomplished by bandaging the eyes, or by placing the patient in a dark room, but neither of these procedures is desirable on account of the depressing effects on most patients. As a rule *abstinence from all forms of near work*, combined with an outdoor life, answers the demands of the majority of cases.

#### **Eye Rods.**

These are simply *glass or hard rubber rods* that have pointed, bulbous, or flat ends and are used for both ointments and solutions.

#### **Bandages.**

*The triangular bandage* is the one most frequently used by me. It consists of two layers of sterilized gauze, between which is placed a layer of absorbent cotton. These are together cut of the proper shape and size to cover the orbit, say about two inches in diameter. It is laid smoothly upon the closed lids and held in place by three strips, each one inch wide, of zinc oxide adhesive plaster. Number one is placed horizontally over the supraorbital edge, the second extends from the nasal extremity of number one obliquely downward and outward along the side of the nose, while the third joins the temporal extremity to the lower end of the second strip on the cheek. These adhesive strips keep the dressings securely in place. Unlike other bandages, there is little or no danger of its slipping off during the night, or as a result of the patient's efforts, as is apt to happen in the case of children.

*The lids may be prevented from adhering or the lashes from sticking to dressings* by applying any simple, non-irritating ointment to the palpebral margins or to the dressing itself.

*Roller bandages*, of gauze or muslin, from 1½ to 2 inches wide and 5 or 6 yards long, are used in ophthalmic surgery, not only as a

means of protection, but for applying pressure to the lids and eyeball. For the latter purpose the depressions about the globe should be carefully and evenly filled with absorbent cotton and the bandage applied firmly about the head.

The application of the bandage should begin on the forehead just over the affected eye. It ought then to be carried around the forehead across the opposite temple, obliquely down over the occiput under the ear of the affected side and thence obliquely across the eye dressing. It should again be passed around the head, but above the ear of the affected side, then *over* the forehead to the opposite temple and obliquely down the occiput, *under* the ear on the affected side and obliquely to the eye. This should be repeated, carrying the roller alternately above and below the ear on the affected side, until the bandage is firmly applied, fixing the dressing and keeping it from slipping.

*The Moorfields bandage* consists of a piece of linen, 3 inches wide by 7 inches long, with a notch of sufficient size in the center, into which the nose fits. Four tapes, one at each corner, are so arranged that loops are formed and surround the ears. The tape is then carried singly around the occiput and forward on the forehead.

*Automobile and car drivers' glasses* are made of cork and mica, celluloid and concave glass, plain and tinted, for the protection of the eyes from wind and dust, that would otherwise injure the delicate corneal and other ocular tissues. They fit snugly about the orbit and are found in great variety at the optician's and motor car shops.

#### **Cartons.**

These are *compressed tablets* containing enough of the remedy to make collyria of a certain quantity. For example, cartons of boric acid crystals are in the market which, when dissolved in sterile water, make a 2 per cent. saturated solution sufficient for a day's use of the antiseptic in question. Practically they are the same as *tabloids* or *solubles* (q. v.) except that they furnish a larger amount of sterile liquid.

#### **Papers.**

##### *Chartæ.*

"Papers" are pieces of absorbent paper that have been treated with medicinal substances. Only one is official in the U. S. P.—Mustard paper, intended to be dipped into warm (not hot) water and applied to the skin as a rubefacient. In prescriptions papers are ordered by the square inch, thus:

℞

Chartæ sinapis,

2x3 inches

Dip into warm water and apply to the temple.

R

Chartæ epispasticæ vel cantharidis, 2x3 inches

To be applied above the right eyebrow until it blisters.

### **Collapsible Tubes.**

*Collapsules.*

Although it may seem a small matter, yet the need of some improvement over the ancient and dirty habit of dispensing eye salves in small pots in which the contents are, during use, continually exposed to every source of contamination must appeal to the careful surgeon. This end is met by the employment of *collapsible tubes*.

These are *generally made of pure tin* and with them is sometimes provided a glass tube or camel-hair brush for applying the salve to the eye.

A small quantity—from 2 to 8 grammes or  $\frac{1}{2}$  to 4 drams—of the ointment is prescribed and ordered to be supplied to the patient, while a larger amount is put up for the surgeon. In this way most salves, protected from the air and other sources of sepsis, keep fresh and unpolluted indefinitely. The required amount needed for daily applications can be squeezed out at will, the small cap returned to its place, and the tube is ready for the next occasion.

### Gelatine Discs.

*Lamellæ.*

Gelatine forms a good vehicle for those alkaloids, such as cocaine, atropia, homatropine, hyoscyne, etc., that are most commonly employed in the treatment of eye diseases and for the determination of the refractive condition. Made up as small, round and thin wafers and placed for protection in glass bottles, they form a convenient and accurate means of applying these powerful agents to the eye. Spread out on a piece of clean paper the tip of a moistened camel hair brush is applied to the center of the disk. It adheres and may then be placed upon the exposed sclerotic or in the conjunctival sac there to undergo solution and absorption.

Lucien Howe (p. c.) has drawn my attention to the fact that in England *dextrin* is used *instead of gelatine* in the manufacture of ophthalmic discs.

### Hypodermic Syringes.

In ophthalmic surgery it is important that *syringes for special use* should be employed and not one syringe for all purposes. The *Extra Pharmacopeia* divides hypodermic syringes into the following classes:

1. Metal or vulcanite mounted (capacity 15 or 20 minims), with glass barrels. 2. All glass. 3. All metal, graduated in 20 minims. 4.

Antitoxin, capable of thorough sterilization, capacity 3, 5 and 10 cubic centimeters, in plated metal cases. The tightness of the piston is adjustable. 5. Syringes with bent, blunt needle having wide lumen, suitable for injection of sterilized paraffin in plastic operations. 6. Eucaine syringes for use with Beta-eucaine solution for infiltration.

*Hypodermic cups*, of glass, are intended for holding the solution for injection while drawing up into a hypodermic syringe, or for dissolving a tablet with the aid of a glass rod as a pestle.

#### Ophthalmic Discs.

For the convenience both of the surgeon and his patient a number of manufacturing chemists have placed upon the market small disks containing agents most commonly used in ophthalmic practice. These are patterned after the hypodermic tablets in general use and form a convenient means of furnishing freshly prepared collyria. They are made with some innocuous and readily soluble vehicle like borax, sodium bicarbonate or boracic acid.

#### Ophthalmic Bottles.

Lang has invented an ingenious *container for ophthalmic solutions and ointments*. It has no ledges upon which dust can accumulate and the cap of the bottle when removed stands upon three points so as to take up the minimum of dust. A small rod or pipette is in the inside of the bottle and with it drops can be removed for instillation.

In another form of *drop bottle* a groove in the neck and glass stopper forms a continuous channel through which fluids from the interior flow without the necessity of removing the cork. Turned at right angles access to the interior is completely shut off. In this way the contents may be kept sterile and clean for the longest time possible.

#### Pencils.

*Sticks. Fused cylinders. Points.*

When it is desirable to apply solid substances to the tissues these are conveniently applied as moulded cylindrical forms like lead pencils. Good examples are *silver nitrate*, *alum*, "*lapis divinus*," iodic acid and other agents fused and run into moulds. Quite a few remedies, like *pyoktanin*, are made like the following convenient *modified copper sulphate pencils* for trachoma and other forms of granular lids into which *orthoform* enters:

R<sub>x</sub>

Cupri sulph. pulv.	10.00
Orthoform.	5.00
Holocain. hydrochlor.	

Tragacanth.

ṡṡ 4.0

Aquæ dest. q. s.

Mix thoroughly and roll into pencils of convenient size.

There are numerous other formulæ made up in this shape.

#### **Soloids.**

This is a trade name (Burroughs, Welcome & Co.) given to soluble tablets for the preparation of fresh solutions of drugs. They are a convenient means of carrying about especially agents that in solution are likely to deteriorate in a short time—certain collyria, for example.

#### **Solubes.**

These are tablets, better known in Great Britain, of remedial agents combined chiefly with sodium chloride and colored blue. They are of several sizes, and are intended for solution in various quantities of sterile water. The smaller are used in ophthalmic practice.

#### **Sprays.**

##### *Nebulizers.*

It seems strange that these appliances, so useful in the throat and nose should be so little employed in ophthalmic practice. Perhaps the difficulty experienced by the patient, who cannot see precisely what he is doing during the performance, may have something to do with this unpopularity. From time to time there appear on the market ingenious devices for the purpose, but they do not have a ready sale. I have elsewhere given the favorable experience of Claiborne in the use of certain spraying solutions (q. v.) and I would suggest that this method be given a trial (with an ordinary water nebulizer) in office practice especially. For home treatment there are on the market a number of pocket sprays, useful for applying evaporating lotions and collyria.

#### **Sterules.**

These are *glass capsules filled with sterile solutions* for ophthalmic and general use, chiefly in Great Britain. The sterule (ophthalmic) is inserted through an ejector, and its breech end is snapped off at the file mark. It is drawn further through the ejector, held horizontally, and the other end is broken off at the file mark. The breech end of the ejector is now covered with the index finger, and the soft part is pressed with the thumb and second finger to release a small quantity (sufficient for one application in eye work) of a sterile solution. The file marks are situated one-fourth inch from the ends of the "sterule."

#### **Tablet Triturates.**

##### *Tablets. Tabellæ.*

Under this name tablets for the preparation of ophthalmic solutions are marketed by some firms.



They are usually made by thoroughly triturating powdered medicines or medicated liquids with finely-powdered sugar of milk or with powdered sugar, moistening the powder with sufficient alcohol to make a paste, and pressing it into moulds consisting of a plate perforated with holes, and then pressing out the tablets by fitting this perforated plate over another plate, upon which are situated pegs that accurately fit the perforations. When the alcohol evaporates and the tablets are dry they are ready for use. These preparations have become very popular within the past few years.

In common with other physicians the ophthalmologist will find the tablet-triturate a very useful form in which to prescribe his remedies. They also suggest other remedial forms for the local application of drugs. See *tabloids*, *discs*.

According to the *Extra Pharmacopeia*, in the preparation of tablets the material has first to be granulated, to make it flow easily from the hopper and to prevent it sticking between the dies and punches of the machine. This is effected by moistening it with a little alcohol or water (to which, if desired, a minute quantity of mucilage, diluted about 1 to 4, may be added), rubbing through a suitable sieve (No. 16), and drying thoroughly either by very slight heat, or better, by exposure to the atmospheric air if sufficiently dry at the time. The decomposition, melting points or volatility of the chemicals to be compressed must be borne in mind. Salol, beta-naphthol, benzoic acid, sulphonal, trional and phenacetin should not be heated.

As they readily dissolve in water they exhibit, like *tabloids* (q. v.) an excellent opportunity of furnishing fresh, aseptic solutions for application to the eye. They can be carried about, either by the surgeon or the patient to be used when needed without danger of the decomposition and deterioration to which most solutions are exposed.

As an example of the convenience and safety of these medicinal agents I refer to the employment of Schleich's *infiltration anesthesia method*. It is convenient to have a properly prepared fresh, sterile solution at hand for intradermal injection. This need is met by the use of tablets, each of which is to be dissolved in 100 c.c. of sterilized water, thus making the necessary infiltration fluid ready for the syringe. As prepared for the market they can be had in three strengths, as follows:

	Strong.	Normal.	Weak.
	1	2	3
Cocaine hydrochlor.	0.20	0.10	0.01
Morphia	0.025	0.025	0.005
Sodium chloride	0.20	0.20	0.20



**Tabloids.**

Under the trade name of *tabloids* Burroughs, Welcome & Co. have on sale *small disks* that are almost instantly (30 seconds) dissolved in the ocular secretions when introduced into the conjunctival sac or applied to the eyeball. Small tinted tubes contain 12 to 25 tabloids and protect them from dust, air and light. If the dose of a whole tabloid is not required it can be dissolved in water and any part of it used as a collyrium. Most of the ordinary drugs used in treating diseases of the eye and in determining its refraction are represented in this list.

## CHAPTER VII.

### SOME OF THE INTERNAL REMEDIES COMMONLY USED IN DISEASES OF THE EYE.

*Amyl Nitrite Anesthesia—General Anesthesia—Spinal Anesthesia by Scopolamine—Morphia — Antithyroidine—Aspirin—Atoxyl — Brucine—Deutschmann's Serum—Colchicum—Dormiol—Gelatin—Iodides—Pancreatine—Trypsin—Mineral Springs—Nux Vomica—Solurool—Sodium Salicylate—Pilocarpine and its Salts—Pulsatilla—Quinine—Tuberculin—Serum Therapy—Validol.*

Although the treatment of systematic conditions that produce, accompany or arise from ocular affections is frequently the peculiar function of the internist or general surgeon, the ophthalmologist has learned that in certain cases the dosage, form and mode of exhibition of certain remedies require modifications in the conduct of eye diseases. It is proposed to consider quite briefly a few of the most important of these agents. The sections contributed by Drs. Croftan, Hecht and Irons must be consulted for further enlightenment.

#### **Amyl Nitrite.**

*Amylo-nitrous ether. Amyl nitris.  $C_5H_{11}NO_2$ .*

Ethereal, yellowish liquid, of a pungent aromatic taste and a peculiar fruity odor; very volatile and inflammable. It is never used locally in eye diseases, but is generally *inhaled as a cardiac stimulant*. Small doses stimulate the heart muscle, increasing the force and rapidity of the heart, while overdoses produce the opposite effect. It also increases the amount of urine and sometimes sets up a temporary glycosuria. *Pearls* made of very thin glass are on the market, each containing a dose—2 to 5 minims (0.20-0.30 cc.)—of the drug. One of these is crushed in a piece of gauze or a handkerchief and slowly inhaled. Flushing of the face, slight tinnitus, and even vertigo accompany the rush of blood to the head, which it is the purpose of the drug to accomplish.

It is used in tobacco-alcohol amblyopia (q. v.) partly as a remedy and partly to determine whether a temporary improvement in vision will follow the improved supply of blood to the starved optic nerve. If this occurs the prognosis is decidedly more favorable than when no such improvement follows. It is also used in *quinine amblyopia* and

in forms of optic atrophy as an adjunct to other treatment; also as a heart stimulant in *cocaine* (*q. v.*) poisoning.

### Anesthetics, General.

#### *Anesthesia by inhalation.*

This brief mention of general anesthetics is intended to draw attention to the chapter on that subject in this System by Dr. Peterson while, at the same time, quoting a few authorities from the ophthalmic side.

Sydney Stephenson (*Ophthalmoscope*, Oct., 1908), in a review of this subject, reminds us that a general anesthetic is required in some operations on the eye, for instance, *acute glaucoma*, and adds that "in children there are few operations that can be done with comfort to the surgeon or with safety to the patient under local anesthetics, for in them it is not pain so much as fright that has to be avoided. Until recently chloroform was the favorite anesthetic, probably because it was generally available, kept well, and called for no complicated apparatus, like ether, liable at any moment to get in the operator's way. Doubtless, chloroform or ether will remain the anesthetic for such operations as require a period of prolonged unconsciousness. For *brief periods of anesthesia*, however, such as suffice for most operations upon the eye, *ethyl chloride is the best agent*, as he has pointed out elsewhere.<sup>2</sup> Valude<sup>3</sup> has also spoken highly of *ethyl chloride* for operations on the eye requiring only a short period of narcosis. B. Hird<sup>4</sup> tells us that *ethyl chloride has largely replaced gas and to some extent chloroform* as a general anesthetic at the Birmingham and Midland Counties Eye Hospital. With ethyl chloride a patient may be anesthetized, operated on, and recover all within five minutes, an economy of time that will be appreciated by all who have to work in a busy outpatient department. Preliminary preparations, however, should not be neglected, since the after-effects of the anesthetic, as Chaldecott<sup>5</sup> insists, depend very much upon whether the patient has or has not been properly prepared for the administration. Ethyl chloride is speedy, relatively safe, easy to give, and produces a flaccid anesthesia free from muscular twitchings, so embarrassing to the ophthalmic surgeon. Vomiting, in the reviewers' experience is generally due to an overdose."

Gendron and Servel<sup>6</sup> recommend *chloride of ethyl, followed by chloroform*. The former is pushed until the patient does not react to

<sup>2</sup>The *Ophthalmoscope*, April, 1904.

<sup>3</sup>Recueil des travaux dixieme Congress internat. d'ophtalmologie, Sept., 1904.

<sup>4</sup>The *Ophthalmoscope*, March, 1905.

<sup>5</sup>Clinical Journal, Aug. 1, 1906.

<sup>6</sup>La Clinique Ophtal., May 25, 1906.

pricking or pinching, when chloroform is substituted for it. The authors have used the method for all sorts of ophthalmic operations in two hundred and fifty patients of all ages, and claim that it causes little excitement and hence little shock; that very little anesthetic is used; that vomiting and other accidents are exceptional; that patients recover so rapidly that they are frequently able to walk back to the ward and to resume full diet on the same day; and that in urgent cases anesthesia may be induced by it even during the digestion period.

Stephenson speaks highly of the ethyl-chloride-chloroform sequence, when administered by a competent anesthetist. The saving of time is great, the anesthesia satisfactory, vomiting rare, and recovery rapid. It is a method of general anesthesia that he recommends in ophthalmic work.

"But," he adds, "it must be admitted that the maintenance of quiet anesthesia during operations on the eye is often a matter of some difficulty. For this, as F. W. Hewitt\* has pointed out, there are three main reasons: first, the position of the patient, so that the mucus and saliva flow backwards and induce reflex disturbances; secondly, fluctuations in the depth of the anesthesia, owing to the anesthetic having to be intermitted from moment to moment to meet the requirements of the operator; and, thirdly, the fact that the eyes are often not available as guides. As Hewitt remarks, 'there have been a large number of chloroform fatalities in ophthalmic practice, and the explanation of the fact is probably to be found in these considerations.'"

### **Anesthesia, Spinal.**

#### *Medullary anesthesia.*

As this method of producing anesthesia is of little use to the ophthalmic surgeon, it is only mentioned to draw the attention of the reader to the ocular complications that occasionally arise.

Blanluet and Caron\*\* record (*Annales d'Oculistique*, Jan., 1907) a case of paralysis of the left external rectus following an *intra-spinal injection* of one-half cc. of a 10 per cent. solution of *stovain* for the production of anesthesia. Four days after the operation the patient complained of pains in the top of the back and neck, which were accompanied on the following day by nausea and one attack of vomiting. The pains spread to the head in the course of two or three days, after which they gradually diminished, and had quite passed away at the end of a fortnight. Eight or ten days after the operation the patient developed diplopia, which was found to be due to paralysis of the left external rectus. At the end of six weeks the range of movement out-

\**Anesthetics and their Administration*, 1907, p. 221.

\*\*Review in the *Ophthalmoscope*, May, 1907.

wards of the left eye had improved from  $15^{\circ}$  to  $30^{\circ}$ , after which it appeared to remain stationary. The patient was found to have a *bruit* and some albuminuria, and gave a history of a previous attack of the latter; but nothing else abnormal could be found, so the authors conclude that the paralysis was due to the injection. They have collected eleven similar recorded cases of *ocular paralysis following intra-spinal injections of novocaine and stovaine*, all, with one exception, unilateral, and suggest that the occurrence may be due to a selective toxic action of the drug (in which case the paralysis might be expected to be bilateral), to a hemorrhage, or to a mild meningitis. There is no case recorded of a similar accident following an injection of cocain.

**Anesthesia (General) by Scopolamine-morphia Injections.**

Blos and Korff advise the following plan: gr. 1-50 of scopolamin hydrobromide and gr.  $\frac{1}{2}$  of morphin sulphate are dissolved in three grams of distilled water and one-third of this mixture is injected into the arm two and a half hours before operation; a similar injection is made one hour later; the third one hour after that, i. e., half an hour before the time set for the operation. The patient who meanwhile should be kept perfectly quiet, becomes drowsy and sleepy after the first injection. After the third injection he is insensitive to pain. Should anesthesia be incomplete half an hour after the third injection, a small quantity of chloroform or ether is administered. For ophthalmic operations, two injections are generally sufficient if a little cocaine has been instilled into the eye.

There is practically no stage of excitement in this method of anesthesia and patients scarcely know that they have been taken from their beds. Post-operative pain is uncommon and patients rest well for from 15 to 24 hours after operation. Vomiting or restlessness is exceptional.

Segelken is also a strong advocate of this form of anesthesia. He employs *Scopomorphin* (q. v.), a trade compound that contains scopolamin hydrobromide, gr. 1-50; morphin hydrochloride, gr.  $\frac{1}{2}$ ; distilled water, 30 drops. One-third of the solution is injected three hours before operation, and one-third an hour and a half later. It is rarely necessary to inject the remaining third. The operation is done as soon as the patient is in a deep sleep. It is well, just before operation, to drop cocaine into the eyes. Segelken has employed this method for several years, and in his practice it has replaced general anesthesia, except in the case of children.

Sydney Stephenson (*Ophthalmoscope*, Oct., 1908) points out that scopolamin-morphin-chloroform anesthesia is by no means devoid of danger to life. This point, he says, has been brought out by Whitacre

who has adopted the plan in 40 cases. He notes a mortality amounting to 4 in 2,400 cases, and believes that the deaths were directly due to scopolamin.

Gallenga adopts a modified plan, which will doubtless recommend itself to many ophthalmic surgeons. One hour before chloroform is administered he injects the scopolamin and morphin. By this means the period of excitement is lessened, vomiting is avoided, and but little chloroform is used.

#### **Antithyroidine-Moebius.**

*Serum Antithyroideum, Merck.*

An amber colored liquid with a faint odor and taste of carbolic acid—the *blood-serum of sheep from which the thyroid gland has been removed at least six weeks before*. The fluid is preserved by the addition of 0.50 per cent. of phenol. It is administered in initial doses of half to one cc. (8 to 15 m.) three times daily, to be increased as required.

Commenting on this and other antithyroid preparations, the Editor of *New and Non-Official Remedies* (3rd edition) says:

"The use of these preparations is based on the theory that the thyroid gland secretes products which are toxic but which neutralize and are neutralized by other toxic substances produced elsewhere in the body. Removal of the thyroid glands, therefore, leads to the accumulation of these second toxic substances, as evidenced by the phenomena cachexia strumipriva and myxedema. On the other hand the blood or milk of such animals is claimed to be capable of preventing the effects of a hypersecretion of thyroid substance, such as is supposed to occur in Basedow's disease (exophthalmic goiter).

These views are still largely hypothetical; but many clinical observers report distinctly beneficial results in the milder forms of the disease and in obscure nervous disorders which are supposedly connected with thyroid hypersecretion. The effects are less pronounced in the more severe forms. The action is merely palliative and other measures of treatment should not be neglected.

Improvement occurs in two or three weeks and is indicated by an amelioration of the nervous symptoms, tremors, palpitation, insomnia and excitability.

The administration must be long continued. Oral and hypodermic administration are equally effective, but the former is usually preferred. These preparations are not toxic, even when very large doses are used."

#### **Aspirin.**

*Acetylsalicylic Acid.*  $C_9H_8O_4$ .

A compound obtained by heating acetyl chloride in a flask to 302° F. (150° C.). It is found as small, acidulous, colorless crystals, slightly soluble in water, more so in alcohol and ether.

This willow preparation, allied to salicin and salicylic acid, I have found in gram doses three of four times daily, of decided value in severe cases of iritis and other uveal affections. It is best administered in capsules, with or without sodic bicarbonate. Wicherkiewicz (42) has employed it with success in chronic conjunctivitis due to long standing gonorrheal infections, in iritis, iridocyclitis, scleritis and episcleritis, rheumatic choroiditis with vitreous exudations and glaucomatous manifestations. It is less prone to produce tinnitus, and gastric disturbances than the salicylates.

Wm. G. Craig (p. c.) employs aspirin, generally in doses of 15 grains night and morning, in all such painful eye diseases as *iritis*, *keratitis*, *corneal ulcer*, *glaucoma*, and *after injuries and operations*. He is so impressed with the value of this drug that he uses it to the exclusion of all other anodynes.

#### **Atoxyl .**

This compound has been successfully employed in the internal treatment of ocular syphilis by several authorities, among them Darier (*The Ophthalmoscope*, July, 1907), Gifford (*Ophthalmic Record*, March, 1908), and Bargy (*Annales d'Oculistique*, Jan., 1908) in *iritis*, *interstitial keratitis*, as well as in sympathetic ophthalmia and trachoma. Sydney Stephenson declares that, after a considerable experience of the drug he has obtained in *parenchymatous keratitis* results that he had not been able to accomplish in any other way. In this disease, as well as in other cases, subcutaneous injections of from 0.25 to 0.50 grammes are given in the buttocks two or three times weekly until a dozen injections have been taken, the total dosage not to exceed 6 grammes. These exhibits may be presented in conjunction with other treatment.

Patients stand the treatment very well, though nausea, epigastric pain and vomiting are likely to follow 0.75 to 1.50 grammes—10 to 23 grains.

I have had some experience with the hypodermic use of this remedy in *tubercular iritis* and *chorioretinitis*, and so far as can be judged from its effects in a few cases, the results were decidedly favorable, and no untoward toxic symptoms showed themselves. This has not been, however, the report from all quarters. R. Koch (*Deutsche Med., Wochenschr.*, 46, 1907) during treatment of "sleeping sickness," reports 22 cases of blindness without ophthalmoscopic signs, while Fehr, Krudener, Nonne and Terrien all report loss of vision from optic



atrophy (mostly post neuritic) following its use. Morax (*Annales d'Oculistique*, Jan. 1908) gives a complete review of the amblyopia from atoxyl showing that if a powerful and effective remedy it is also a dangerous one, especially when employed in maximum doses. *These poisonous effects may be avoided, as the report of Morax teaches, by giving small doses frequently rather than occasional larger ones. No visual disturbances follow the use of half a gramme, (or 7½ grains) and this should be regarded as the maximum dose.*

### **Brucine.**

One of the alkaloids found in *Nux vomica* and *Ignatia* in varying proportion and in conjunction with strychnine. It occurs as white crystals. There are several salts, more soluble in water than the pure alkaloid, on the market. These are, chiefly, the hydrobromide, hydrochloride, nitrate and sulphate.

As the ophthalmologist relies on the hypodermic use of nervine tonics and stimulants this rival of strychnia should not be forgotten. Skorjuchow (12) prefers a preparation which contains less than 0.1 strychnin. It is injected under the skin of either the temporal region or of the arm in quantity varying from 0.005 to 0.02 gm. When the injections are made daily he generally uses 0.01, and if the intervals are greater he uses 0.02.

The number of injections in cases of optic nerve atrophy were twenty-six and from forty to fifty in cases of retrobulbar neuritis. In employing this treatment one must be careful to keep a close record of the visual field and to stop the treatment if there appears the slightest evidence of retinal irritation. He has employed the treatment in forty-six cases (eighty-nine eyes) and in sixty-seven eyes improvement was noted. In eighteen no result was obtained, while in four eyes the process grew progressively worse. All in all, he thinks that this drug increases the intensity of the central and peripheral vision of both healthy and diseased eyes, stimulates the action of the eye-muscles, diminishes the grade of the paresis, and frequently produces dilatation of the vessels of the fundus. He advises its use in various forms of amblyopia, in acute and chronic retrobulbar neuritis of either alcoholic or other origin, in ordinary optic nerve atrophy, in retinitis pigmentosa and in various forms of ocular paralysis. It is to be preferred to strychnia in the treatment of optic nerve atrophy, inasmuch as it produces a dilation of the vessels of the retina, and in this way, promotes the absorption of the pathologic products, while assisting the nutrition of the part. The treatment is contraindicated in all acute inflammations.

**Colchicum.**

The ophthalmologist has to deal with so many instances of *gouty infection*—especially iritis and choroiditis—that he should not ignore the treatment of the general dyscrasia. This subject will be found discussed elsewhere, but, meantime, it is wise to remember the value of colchicum and its preparations. As A. F. Amadon (p. c.) properly says, rapid results follow the treatment of gouty eye diseases, either with *colchicine* alone or by the addition of 1-64 grain of that alkaloid, given from four to six times a day, in conjunction with the iodides or salicylates in sufficient quantities to produce moderately free catharsis. The alkaloid, he adds, seems to be far superior to the tincture or wine of colchicum, and he has noticed that the more decidedly the case is of gouty origin, the more benefit will be derived from its use.

**Organotherapy.**

Of the animal extracts recommended as therapeutic agents during the past few years we are mostly interested in those from the *adrenal glands*, described under *Vaso-constrictors* (q. v.), from the *thymus gland*, the liquid extract ( $\frac{1}{2}$  to 2 fld. drachms) and dessicated powder 3 to 5 gr. of which have been given thrice daily with some success in *exophthalmic goitre* (q. v.), and from the *testes* and *retina*.

*Didymine*, or testicular substance, marketed by Burroughs, Wellcome & Co., in 5 grain tablets has been prescribed with effect in Basedow's disease and by Dor for *asthenopia* in children when accompanied by unduly rapid growth.

*Optocine*, from the retinae of freshly killed animals, is so prepared that one fluid ounce contains the activities of four retinae. The itis pigmentosa, and myopic choroiditis.

R. W. Doyne\* first introduced this product and advised its use in the treatment of retinal affections, including tobacco amblyopia, retinitis pigmentosa, and myopic choroiditis.

**Deutschmann's Serum.**

A polyvalent serum from rabbits fed on yeast, and prepared by R. Deutschmann\*\* by a special method. For this purpose increasing doses of yeast are introduced by mouth into the animal's body, and these are thought by the author to lead to the accumulation in the animal's blood of protective or defensive substances. The serum, obtained from such blood gives the human organism increased power of resistance in the battle against pneumococci, staphylococci, streptococci,

\*Extracts from various portions of the ocular apparatus have also been employed in ocular therapy by Dor (1897, Lagrange (1898) and Darier (1900).

\*\**Münch. Medizin. Wochenschr.*, No. 9, 1907; See Merck's Reports, 1908.

etc., or their toxins. Injected into the muscles it is said to improve the general condition of patients, to reduce febrile temperature, while it is reported to be perfectly harmless. For adults doses of 3—4 c. c. are used, for children 0.75—1 c. c. Deutschmann considers the serum to be indicated in pneumonia, septic and pyæmic infection, erysipelas, influenza, acute tonsillitis, *severely infected wounds of the eye, hypopyon keratitis, relapsing iritis, irido-cyclitis, sympathetic inflammation* (in which the exciting eye was not removed) and in tuberculosis.

Deneke\*\* tested the serum in 32 cases of croupous pneumonia, and came to the conclusion that its curative action was not proved. This view is also generally held.

#### **Dormiol.**

*Chloral-amylene hydrate.*

This compound is obtained by mixing anhydrous chloral with amylene hydrate.

It is an oily, colorless fluid, with an odor of camphor and a cooling taste. It does not mix with water but ethyl alcohol and fixed oils readily dissolve it. Würdemann advises it as a safe and reliable hypnotic after cataract extraction. The dose is  $\frac{1}{2}$  to 1 dram (2-4 cc.) of a ten per cent. solution.

#### **Gelatine.**

The chief use to which his agent is put in the internal treatment of ophthalmic diseases is its exhibition as a blood coagulant.

Tubes of sterile, concentrated, saline gelatin solution are prepared for injection into the gluteal muscles as a hemostatic in retinal and choroidal hemorrhages and in ophthalmic aneurism. Each makes a 2 per cent. solution with boiled water of five ounces, constituting one injection at 103° F. Sometimes stronger solutions are employed at a somewhat higher temperature.

#### **Iodides and Other Compounds of Iodine.**

Potassic iodide has held its own in spite of the many objections urged against its prolonged use, despite the symptoms of iodism set up in persons susceptible to its poisonous action and notwithstanding the frequent substitution of other remedies for it. Although I have made trial of many drugs, idonucleoid, iodalbin, sodium iodide, strontium iodide, mixtures of other iodides, etc., said to exhibit superior virtues yet, on the whole, have found no iodine preparation equal to this potassic salt for the internal treatment of cases properly calling for its employment. When the full strength of the iodide is desired (as it generally is in ocular therapeutics) large doses may, in nineteen instances out of twenty, be given with comfort and safety for several

\**Deutsch. Medizin. Wochenschr.*, No. 4, p. 172, 1908.

weeks at a time. My plan is that recommended by Baker (41). One begins with a fair-sized dose, say 100 minims three times daily, of the following solution :

℞	
Potass. iodidi	℥iii
Aquæ dest. ad	℥l. ̄vi.

The patient takes the dose with a large quantity—a pint and a half—of water, between meals. He may swallow the dose in a small quantity of water and take his time about drinking the remainder of the diluent ; if he can drink 30 ounces of the liquid, all the better. The bowels should be kept open, and if the skin can be made to act freely by a bi-weekly Turkish or pilocarpine bath (q. v.), the less the danger if iodism. Of course, the kidneys should be competent and there should be no contraindication to the use of iodides in general. The daily dose can generally be increased 20 to 50 minims, using a minim measure for the purpose, until the patient is taking 300 or 400 grains of the iodide daily. At the end of 2 to 4 weeks I intermit the treatment a week or two, as seems desirable. Following this plan I rarely have any serious trouble from intestinal irritation, coryza, dermal eruptions or other toxic symptoms.

As Baker points out, it sometimes happens that large doses will be tolerated when small ones are badly taken. Large doses should not be limited to specific cases, but are indicated in most instances of optic neuritis, ocular paralysis, choroiditis, serous iritis, relapsing iritis, cyclitis, and in interstitial keratitis. They are contra-indicated in gray atrophy of the optic nerve and in most cases of post-neuritic atrophy. Albuminuria is also a contra-indication and the iodide should be cautiously given to children, who do not take it kindly.

J. A. Tenney (p. c.) believes that the effects of potassium iodide are much increased when that drug is given with the *compound syrup of stillingia*.

C. L. Minor (p. c.) gives the *saturated solution of the iodide of potash in milk* in gradually increasing doses, beginning with fifteen grains a day and increasing fifteen grains a day (in divided doses) to the point of tolerance, be that any number of grains from the original dose to two hundred grains three times a day ; at the same time, when indicated mercurial inunctions are used once a day. He usually adds a *steam bath*, daily, to aid elimination. He has never had any kidney lesions or other unfavorable symptoms develop during the course of such treatment, although examinations are made every day.

#### **Mercurials.**

A. Duane (p. c.), prescribes mercurials freely in iritis, uveitis,

choroiditis and optic neuritis, even when not evidently or even probably syphilitic. In specific muscular paralysis he has had good results from *intramuscular injections* of a one per cent. bichloride solution in the gluteal region. Internally in these conditions and also in *phlyctenular keratitis*, he has often used *calomel* in 1-10 grain doses 4 or 5 times a day. For children and often adults, this dosage is kept up for weeks without trouble and with evident benefit. In adults he has found Squibb's tablets of *red iodide of mercury* (1-16 grain) well borne, and of course, they can be combined with potassium iodide.

F. E. Woodruff (p. c.) uses, and has not found anything equal to the speedy effects to be derived from, *deep hypodermic injections* of 8-10 minims of the following prescription. It is repeated daily and in increasing doses until one gets the physiological effects:

R

Hydrarg. bichlor.

Acid carbolic

āā gr.viii

Sodii chlor.

gr.xx

Aquæ dest. ad

fl.ʒi

#### Mineral Waters.

##### *Springs, and Other Health Resorts for Diseases of the Eye.*

Apart from the treatment of those general conditions that influence ophthalmic diseases, it cannot be said that there are any mineral springs, or sanatoria connected with them, either in this country or abroad, that are particularly efficacious in ocular therapy *per se*.

The *change of air and scene*, the *out door life*, the *freedom from business cares* and household worries that a sufficient sojourn at some comfortable health resort produce are of value (apart from the medicinal effect of the waters, either internal or external) in many eye affections, notably in *phlyctenular diseases*, *glaucoma*, accommodative asthenopia, *ocular headache*, and other symptoms following eyestrain. A course of antilithemic and antisiphilitic treatment is particularly appropriate to those affections—*scleritis*, *iritis*, *choroiditis*, *optic atrophy*—when dependent upon these systemic affections. Hot Springs, in both Virginia and Arkansas, as well as the springs at Saratoga and French Lick, Indiana, are well adapted for the treatment of both these conditions and, when judiciously carried out under the care of a competent internist, are to be recommended. In the same way there are, throughout the United States and Canada, similar, though perhaps less known, resorts whose value in the conduct of *gouty*, *rheumatic*, *syphilitic*, *anemic*, *tubercular* and *neurasthenic states* is quite equal to those just named.

A. Trousseau\* has recently discussed this matter, chiefly so far as the French Mineral Springs are concerned. Quite naturally, perhaps, he ignores the justly celebrated baths of Carlsbad, Marienbad, Wiesbaden, Baden-Baden, Homburg, Kissingen and other German resorts, and speaks more particularly of the French and Spanish sanatoria.

Trousseau suggests that cases of *iritis*, *irido-choroiditis* and *scleritis* due to rheumatism—especially if of the *recurrent type*—be sent to Aix-les-Bains. He believes that *the interval of the acute attacks* is the proper time for sanitarium treatment, and he would not permit the continued use of even the water of Aix while an acute attack is in progress.

In the *plastic form of iritis* Bourbon-l'Archambault is the place; Royat for the "quiet variety," while Luchon is excellent for the recurrent type in the rheumatic and anemic. He thinks Contrexville a good place for these diseases when of gouty origin; if very chronic Vittel affords the most relief.

Vichy is also an appropriate resort for patients with *iritis and scleritis* for the "after cure" when the acute stages have passed. He suggests Vichy, also, for diabetes and thinks a season spent there is a good preparation for extraction of diabetic cataract.

In *paresis* of the eye muscles he advises Bourbon-l'Archambault and Nérès; the latter place, also, for the after treatment of *herpes zoster ophthalmicus*.

For *neuropaths* and those suffering from: the *eye troubles of intestinal toxemia*, he advises Plombières and Châtel-Guyon.

Tabetic affections, including *optic atrophy*, if taken early enough are benefited by the waters of Lamalou.

Evian, Thonon, or better, Bourbon-Laney, are the best localities for those subject to *vitreous* or *retinal hemorrhages*.

In cases where conjunctivitis and *recurrent attacks of keratitis* are produced by diseases of the nose or nasopharynx, Luchon, Mont Doré or Satins-du-Jura is to be recommended.

In *phlyctenular disease* of the conjunctiva and cornea, Trousseau advises a sojourn at and treatment by the waters of Saint-Gervais, Royat, Luchon or la Bourboule according to the state of the patient.

*Asthenopia*, due to diseases of the reproductive organs, as well as *iritis and irido-choroiditis* of *genito-urinary* origin, are benefited by a course of treatment at Luxeil. For those ocular troubles encountered at the menopause, the writer recommends Bagnoles de l'Orne.

*Scrofulous children* affected with *recurrent keratitis*, should be

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\**La Clinique Ophthal.*, July 25, 1908.



sent to the seaside; to Berck during the intervals of freedom from the attacks, and to Biarritz as the acuity of the attack is declining. Owing to its freedom from wind and dust Trousseau thinks Arcachon is a desirable resort in these cases at any period of the disease, because of its protected situation amid the pines.

The writer advises Bourboule as a resort for *spring catarrh*, and has known several cases that did not exhibit their customary annual recrudescence after treatment there.

*Syphilitic eye* affections that did not improve elsewhere, he has known to get well under the active treatment practiced at Aix and Uriage; optic nerve diseases due to lues are generally sent to the latter place.

Patients with *interstitial keratitis* of the hereditary syphilitic type, Trousseau sends to Uriage and Biarritz; to the former place even during the progress of the disease unless the case requires constant supervision. He advises Biarritz only at the end of the disease or if there are congestive symptoms. Should Biarritz be found too much exposed he exchanges its sea air and waters for Arcachon.

In addition to the mineral waters already mentioned as valuable in eye diseases the following springs are to be recommended, particularly if the patient, leaving behind him as many of his cares and worries as possible, will repair to the *Hauptquelle* prepared to remain as long as is necessary under the care of a competent local physician and to enjoy, so far as he can, the drives, walks and scenery, as well as the musical and other entertainments that most of these resorts afford.

Baden-Baden; Baden (Switzerland); Bath (England); Bethesda (Wisconsin); Mecklenberg, (Va.) or "Buffalo Lithia"; Cheltenham (England); D'Orezza (Corsica); Ems (Germany); Fiuggi (Italy); Friedrichshall (Germany); Harrogate (England); Hunyadi Janos (Hungary); Kreuznach (Prussia); Neuheim (Germany); Montreux (Switzerland); Ragatz (Switzerland); Reichenhall (Bavaria); Rubinat (Spain); St. Moritz (Switzerland); Salzbrunn (Austria); Tarasp (Switzerland) and Wiesbaden (Germany).

The following British health resorts are especially valuable in *gouty, rheumatic, autotoxic, neurasthenic* and *angiosclerotic* eye diseases: Blackpool (Yorkshire); Bournemouth; Braemar (Scotland); Buxton; Channel Islands (tuberculosis and neurasthenia); Bray (Ireland); Cheltenham; Hastings; Kingstown (Ireland); Ilkley; Malvern (Wales); Torquay (Devonshire); Tunbridge Wells; Ventnor; Mallow (Ireland).

#### **Nux vomica.**

The use of the *tincture* in increasing doses is of extreme value



in all cases of muscular imbalance. In particular, they show results in those instances dependent upon weakness of the nerve supply. de Schweinitz first advocated this method of treatment and advised that the dose be increased to the point of its toxic effect.

### **Pancreatine.**

In the *pancreatic juice* of warm-blooded animals there are at least *four digestive ferments*, as follows:

*Trypsin*, a proteolytic ferment, acting in an alkaline medium, that converts proteids, albumen and fibrin, e. g., casein of milk, into peptones but digests white of eggs with difficulty.

*Amylopsin* or *pancreatic diastase* that converts starch into dextrin, maltose and dextrose.

*Steapsin*, lipolytic ferment that emulsifies fats.

*Remmin*, a milk-curdling ferment converting casein into a form of peptone.

Much of the pancreatin used in America is manufactured by Parke, Davis & Co., and Fairchild Bros. & Foster. It is marketed by them as pure pancreatin, an almost insoluble, cream-colored, amorphous powder with a faint odor and meaty taste, as tablets or as a peptonizing mixture. It is nearly always prescribed with bicarbonate of sodium.

The ophthalmic surgeon is interested in these digestive ferments owing to their alleged power of curing, or relieving the suffering that accompanies malignant growths. The same rules that apply to the conduct of extraocular, malignant neoplasms should be followed in the treatment of *carcinoma and sarcoma of the eye structures*. Especially *after simple enucleation or complete exenteration of the orbit* for any form of malignancy it has always seemed rational to me that the use of either radium, the X-Rays (q. v.) or *pancreatic ferments* (or all) ought to be encouraged.

### **Trypsin Treatment of Cancer, Sarcoma and Malignant Growths.**

Normal tissues are resistant to pancreatic extractives but the solvent *power of trypsin on malignant growths* can be shown in laboratory tests. The use of trypsin and other pancreatic ferments employed clinically also greatly improve the condition of patients with cancer. They lessen pain, improve the nutrition while the growth, it has been noticed, remains localized.

Trypsin injections act by producing anti-trypsins in excess of that present in the normal blood serum. The result may be regarded as resembling the ferment-toxins produced by pathogenic organisms when in contact with organic tissues. (See Irons' references to *Immunity*.) The ferments exist dormant and are termed zymogens. They become

active when in contact with their specific excitors, e. g., the hydrogenions of hydrochloric acid in the gastric juice are thought to be excitors of pepsin-zymogen, or pensinogen.

The following are the forms (see *Extra Pharmacopeia*) in which *trypsin* and its allied ferments are marketed in Europe and employed in carcinoma, epithelioma, sarcoma and other malignant neoplasms.

*Hypodermic injection* of compound *Trypsin-Amylopsin* solution.

This is a proprietary remedy and, to be effective, ought to be freshly prepared. The *injection* is made in sound tissue *near the growth if possible*, otherwise in flank or buttock. The initial dose is 15 minims; then 20 and 30 minims; at first one injection every alternate day; later, every day.

*Hypodermic sterules* contain 30 minims of the trypsin solution. They are also dispensed with cocaine hydrochloride 1-10 grain.

*Amylopsin injection* (*hypodermic*), also amylopsin solution, 30 minims containing cocaine hydrochloride 1-10 grain, are supplied in ampoules. Some authorities believe that amylopsin alone is valueless.

*Holadin* is an extract of the entire pancreas, said to represent all the constituents both of the digestive and internal secretions.

*Glycerinum trypsini*. A concentrated (10 per cent.) solution for dilution is supplied commercially. Five minims of 1 to 3 per cent. solution, prepared by diluting this with water or normal saline, is injected. It is not possible to produce a glycerole of the same strength from the powder usually supplied in commerce.

*Pancreatin* or *trypsin* is given concurrently in increasing doses by the mouth, e. g., as *glycerinum pancreatis*, or *liquor trypsini*, in 1 to 2 drachm doses three times a day before meals, as accessory to the hypodermic injection treatment.

*Cachets* or *capsules* of trypsin 5 grains each, and with *ox gall* 2 grains (which latter is said to strengthen the action of the trypsin) are also prepared.

The *trypsin treatment of cancer* has been investigated by Seaman-Bainbridge,\* R. Hoffman,\*\* and others. Merck (*Annual Reports*, 1907) remarks that a final opinion cannot yet be given of the real value of this agent in the treatment of malignant tumors. He contends that most of the solutions of trypsin on the market are of unknown composition. In these cases it is hence impossible to judge of the dose.

W. J. Morton\*\*\* describes over 30 cases that were benefited by the *injection of trypsin*. In two cases, where the cancer was facial, an

\**British Medical Journal*, p. 486, 1907.

\*\**München. Medizin. Wochenschr.*, No. 46, 1907.

\*\*\**Medical Record*, Dec. 8, 1906.

actual cure is stated to have been produced. The author therefore recommends further trials. R. Morton\*\* disapproves of its use, as his results were negative, and secondary actions occurred. After the injection not only was the pain increased, but inflammation and suppuration occurred although every possible aseptic precaution was adopted. The general condition and the new growth were not benefited in a single case.

A Pinkuss and S. Pinkuss, on the contrary, obtained satisfactory results. They admit that subcutaneous injections of trypsin are painful, but the pain passes off after a short time. The injections were made in the thigh and in the gluteal region; in a case of cancer of the lower jaw, in the upper part of the chest. In no instance did the authors find that the injections were followed by infection, abscess, necrosis or inflammatory reaction. The general condition was not made permanently worse; on the contrary patients usually improved. Transitory alteration in the pulse, fever and rigors were attributed by the authors to the absorption of the products of catabolism. As to prospects of cure, the authors have not yet come to any definite conclusion, although they were satisfied that appreciable improvement was obtained in several cases.

Hoffman employed pure pancreatin in his experiments. In an inoperable, relapsing, ulcerating *carcinoma* of the ear *he applied the remedy to the free surface, in the form of a powder*, covering it with thymol wool to prevent decomposition. The tumor diminished appreciably, the surface became clean, while bleeding and pain diminished. However, the growth of epidermis prevented the pancreatin from coming in contact with the tumor, and the latter continued to grow beneath the epidermis. All the same, the favorable psychic influence exerted on the patients by the diminution in the size of the tumor, and the apparent improvement as described above, justify one in recommending the use of pancreatin in ulcerating carcinoma, especially as this therapeutic measure is painless and inexpensive. In the author's opinion it is desirable if possible to get over the diminution in the amount of the tumor exposed. Hoffman thinks that as much as possible of the tumor surface should be exposed to the action of the pancreatin or trypsin. He would remove all epidermis either by means of the galvano-cautery or by the use of a caustic stick.

#### **Pilocarpine and its Salts.**

As is well known to the ophthalmic surgeon, these are among the

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\*\**Lancet*, p. 897, 1907.

most active and when given, with due regard to the requirements of the case in point, are the most useful agents at our command in the treatment of ocular affections. Their efficacy in many extra-ocular diseases, in *uveitis of all kinds*, in *choroiditis*, *chorioretinitis*, *detached retina*, *optic neuritis*, etc., both alone and in conjunction with other remedies, has many times been referred to in these pages.

As I usually prescribe the *hydrochloride with sweat baths*, I append the directions generally issued to the house surgeon or nurse. I have found that either personal supervision or explicit directions are needed to insure the full effects of the drug. The initial hypodermic dose should be one-twelfth of a grain, to be increased according to the effect of the first bath and as the condition of the patient indicates.

The baths should be given when the stomach is empty. The patient should be in bed and *wrapped up to the chin in a woolen blanket* and again covered with at least four woolen blankets. Under the latter six quart bottles containing *boiling water* should be placed. Pilocarpine (gr. 1-12 to 1-3) should now be given hypodermically. The patient is also given to drink at least a pint of very hot water, very hot and weak lemonade, or very hot tea, to be administered through a bent glass tube, *while the patient is lying down*. In a few minutes he should begin to break out in a profuse perspiration, which should continue for at least two hours, only stopping short of that time if he shows any bad symptoms. At the end of two hours he should be thoroughly dried and the skin rubbed with alcohol and then allowed to rest for another two hours, when he may go out if he wishes.

Balliart\* uses a solution of 0.20 of the nitrate of pilocarpine in 10 grms. of water—about a 2 per cent. solution, in distilled water. He employs this hypodermically in doses of 6 to 10 drops; the latter is equal to a centigram of pilocarpin. He has had favorable results in cases of *chronic glaucoma*, *interstitial keratitis*, exudative chorioiditis, vitreous opacities, retinal hemorrhages, detachment of the retina, the fundus changes of progressive myopia and in toxic amblyopia. He claims that *injections of pilocarpin* are of benefit in all affections of the deep structures of the eye that are accompanied by infiltration or exudation.

He lays stress on the necessity of great care in making the injections.

#### **Pulsatilla.**

*Easter flower. Dane's blood. Pasque-flower.*

The whole, dried plant of *Anemone pulsatilla* contains tannin and *anemonin*, a colorless, odorless, insoluble acrid camphor. The N. D.

\**Bulletin de Therapie*, Sept., 1906.

says that there is probably no drug in the pharmacopeia that has been used in so many diseases or had so many virtues attributed to it. We need not be surprised to learn, then, that in medicinal doses of 2 to 5 grains (0.10-0.30) or of anemonin, gr.  $\frac{1}{8}$  to  $\frac{1}{2}$ , it has been recommended as *curative of cataract*, especially by those who have not made an extensive study of that particular metamorphosis. (See *Cineraria maritima*).

### Quinine.

R. L. Randolph (p. c.), believes that in all forms of *chronic keratitis*, other than the so-called inherited forms of interstitial keratitis, quinine has a specific effect. He uses it as a routine measure, giving at least two grains four times a day. Of course, larger doses are called for in the so-called malarial form.

### Serum Therapy.

The use of the *various antitoxins*, especially in connection with the opsonic index, promises brilliant cures, not only in general, but in ophthalmic therapeutics. Most encouraging are the results obtained by the injection of *tuberculin* (both T. R. and the older form), *diphtheria antitoxin*, as well as the *streptococcus*, *pneumococcus*, *tetanus*, *Deutschmann's "Heilserum"* (q. v.) and other sera. Passing mention is thus made of a few of these to draw attention to the complete treatment by Dr. Irons of this subject.

Speaking of the *sera in ocular therapy* Darier\* reminds us that it is from antiseptics, from prophylaxis and from *vaccination against infections* that Jenner, Pasteur, Behring and Roux have opened to us a new field in ophthalmology. The work of Roux has shown the good effect of *serotherapy in infective corneal ulcers*; that of Hippel has demonstrated cures by the tuberculin of Koch; finally Cr  d  , Wetter and others have arrested infectious processes by the intravenous injections of colloidal silver, by which Trousseau, Loboutre, Bandoine and Darier have obtained similar success in ophthalmology. In 1899 Darier cured a case of diphtheric corneal infiltration with injections of the serum of Roux; since then he has not hesitated to give these injections. Shortly after Roemer published his first cases of infective corneal ulcer treated by antipneumococcus serum, Darier treated three similar cases with antidiphtheritic serum successfully, not being able at that time to procure that of Roemer. Later, however, Darier was able to obtain it, and the results of the effect of the two sera in the cases were identical.

R. W. Allen in the *Practitioner* for May, 1908, draws attention to

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\**La Clinique Ophtalmologique*, June 10, 1907.

the great value of *vaccine therapy in bacterial diseases of the eye*. Whether an ocular tuberculosis be of the human or bovine type is often unknown so that if one variety of tuberculin produces an unsatisfactory result he advises a trial with the other, or to use both together. Conjunctivitis, both acute and chronic, is benefited in the most striking manner by use of the appropriate vaccines, which must be employed with boldness. Vaccine therapy is extremely valuable in the various cases of *corneal ulceration*, especially in the case of pneumococcus and gonococcus. Acuteness of infection is no contra-indication whatever to this mode of treatment, which has proved most successful in infections due to the *streptococcus*, *staphylococcus*, *gonococcus*, *pneumococcus*, *bacillus coli communis*, B. Friedländer, B. Morax-Axenfeld and other organisms.

Darier has also used serotherapy with success in the case of a woman of 72, who after a correct cataract extraction had a corneal infection.

#### **Sodium Salicylate.**

To some extent this drug has taken the place of the iodides and mercurial inunctions in the *treatment* of non-specific *intraocular* inflammations and infections.

The best results in the internal exhibition of this remedy are obtainable by the observance of certain rules, first formulated by Harold Gifford (11). He advises its use in all *non-specific inflammations of the iris, ciliary body, sclera and episcleral tissues*; whether of rheumatic origin or not; in acute retrobulbar neuritis and in glaucoma. He has found the average patient will stand during the waking hours, i. e., 7 a. m. to 10 p. m., one grain to each pound of his weight, and gives it as follows: One ounce of the salicylate is dissolved in four ounces of brandy, which gives approximately 15 grains to the teaspoonful. This is administered every 1½ hours in about 1-8 glass of water followed by the same amount of water or a cracker to get rid of the taste; it is best to begin with a smaller amount at first and the patient should go to bed after the third or fourth dose, being allowed to go without the drug for a day or two each third or fourth day. He is also warned to keep the head wiped dry, if there is perspiration, as a severe cold may be taken. If the stomach rebels a change to giving the drug in capsules, followed by the brandy and water, may be resorted to. Temporary blindness and deafness, as toxic sequels, are extremely exceptional and need have no more weight than the blindness which results from moderate doses of quinine. Some cases of delirium have been reported following its use. The writer has tried aspirin with about the same unpleasant symptoms when enough to produce good results was exhibited.



In cases classed as optic neuritis, there are many conditions not really inflammatory, but due to stasis or thrombosis, in which more faith is placed in large doses of the iodides than of the salicylate; as also in posterior chorioretinitis. Special stress is laid upon the use of this salicylate in *sympathetic ophthalmia, post-operative or traumatic inflammations of the iris and ciliary body, interstitial keratitis and herpes corneæ*.

In sympathetic ophthalmia Gifford places it ahead of mercurial inunctions but frequently uses the two alternately. Emphasis is laid upon the necessity of keeping up the use of the salicylate one or two days a week for a long time after the last sign of acute inflammation has disappeared.

In *interstitial keratitis*, plainly the result of hereditary syphilis, the action of the salicylate is much less active and certain than in those that show no marked luetic signs, but even here it often does more good than both iodides and mercury. Those cases of iritis that not infrequently occur after cataract extraction respond most promptly to the generous use of the drug.

In *herpes corneæ* the use of the salicylate in connection with local applications of an iodide gives relief where hot applications and atropine fail.

In explaining the drug's action, the rapid elimination from the body by the kidneys is against its being a germicide or germ-hindering substance, as a 1-1,000 to 1-500 solution is necessary to check the growth of ordinary white and yellow pus cocci. The theory of Oltramare is more plausible, according to which "a local depletion is produced by general capillary dilatation which the salicylate causes." In this connection reference is made to the remarkably favorable influence which an optico-ciliary neurectomy (in which a large part of the blood supply to the eye is cut off) exerts upon traumatic inflammations, and the action of cardiac depressants in checking colds. The diaphoresis produced is considered as a secondary factor in the good influences produced by the drug.

W. H. Dudley (p. c.), is in the habit of *prescribing fluid extract or tincture of strophanthus in ordinary doses, with sodic salicylate*, because of the decided cathartic action thus produced.

Desiring to avoid the depressing effects of the salicylate upon the heart he added five minims of the tincture of strophanthus per dose, the use of which produced free catharsis; quite a good number of trials of a modification of the mixture have invariably produced the same results. The mixture has thus a special indication, where salicylates are indicated, and in cases associated with constipation.



In prescribing salicylate of soda R. L. Randolph (p. c.), always gives it with *essence of pepsin*.

R

Sod. salicyl.

ʒii

Es. pepsin ad.

fl. ʒiii

Half to one teaspoonful every four hours.

### Solurool.

*Thyminic Acid; Nucleotinphosphoric Acid.*

A yellow, amorphous powder easily soluble in water and prescribed in *gout, rheumatism, Graves' disease* and in the so-called *uric acid diathesis generally*. The usual dose is from four to eight grains (0.25 to 0.50). Wolfberg has given it internally in full doses for its effect upon *cataract* (q. v.) due to the general causes mentioned.

### Tuberculin.

The employment of this valuable agent, both in the diagnosis and treatment of eye diseases is so important to the ophthalmologist that I have gone rather deeply into the chemistry, mode of preparation, methods of administration and dosage of the various kinds of tuberculin and their substitutes as we find them in the market. It should be added to the following account (for which I am almost entirely indebted to the *Extra Pharmacopeia*) that there are several tuberculin preparations made outside of Germany (in America for instance) carefully manufactured and quite as reliable as the Koch products. These tuberculins and their congeners are, however, practically identical with the German preparations and a description of the one will, I believe, amply suffice for the other.

*Tuberculin, Old. Tuberculinum Kochii, P. G.*

An amber-colored liquid, being an old, glycerine, broth culture of the tubercle bacillus of the human type boiled and concentrated, from which the bacilli have been removed by filtering. It is supplied in 1 cc. bottles and is used (a) in *diagnosis* of tuberculosis, and (b) as an injection for the *cure of disease* due to the tubercle bacillus.

(a) To *diagnose human tuberculosis*. The temperature must not exceed 98.6° F. at the time of the injection. Dose.—One-thousandth of a cubic centimetre (0.001 cc.) diluted to 1 cc. (termed “No. 3 dilution”), or if patient is weakly, or a child, use 1-10,000 cc. (0.0001 cc.) in 1 cc. fluid (called a “No. 4 dilution”).

If there is no rise in temperature after the first injection, inject a double dose on the next day but one following. If the first injection causes even ½° F. rise, wait until the normal temperature is reached and again inject the same dose. If the reaction is now more violent than after the first injection tuberculosis is undoubtedly present. If no reaction appears after the first small dose, the dose may be increased

to 5 cc. of tuberculin dilution No. 3 and, finally, to 1 cc. tuberculin dilution No. 2, i. e., 1-100 cc. of the strong liquor. If there is no reaction on twice repeating the latter dose one may conclude that no recent or progressive tuberculosis exists.

*New-Tuberculin Koch—Bacilli Emulsion\** is a suspension of pulverized tubercle bacilli in water with an addition of an equal volume of glycerin. 1 cc. contains 0.005 gm. of powdered tubercle bacilli. Dose --1-2000 cc. (=0.0000025 gm. of bacillary substance) as a rule to begin with. Dilutions are made with 0.8 per cent. sodium chloride solution, or if the dilutions are to be kept several days with 0.8 per cent. sodium chloride and 0.5 per cent. phenol.

With this small dose it is very exceptional for any reaction to appear. At one or two days intervals the dose is rapidly increased from twice to five times the dose at each injection until definite reaction appears with a rise of  $2\frac{1}{2}^{\circ}$  to  $5^{\circ}$  F. in temperature. As soon as such violent reaction develops much longer pauses, 6—8 days, must be made. If, however, it is desired to carry out the treatment without violent reactions, the dose must be increased at a rate which only causes little or no rise in temperature, and between each injection 5 to 7 days' intervals should be allowed. Otherwise the same procedure is followed.

The subcutaneous injections are increased until the dose reaches 20 milligrammes. Larger quantities are badly absorbed. If absorption takes place too slowly, it is advisable to inject the dose at two or more points. The larger doses of 10 to 20 milligrammes are only injected at intervals of 2 to 4 weeks.

*Bovine Tubercle Bacilli Emulsion* corresponds in every respect to New-Tuberculin Koch-Bacilli-Emulsion just mentioned except that instead *tubercle bacilli of the bovine type* are used. Its method of application is like the last mentioned.

In addition to the use of *tuberculinum Kochii* P. G., *Tuberculin A.*, *Koch's old tuberculin*, used for both diagnosis and treatment, and the *new tuberculin*, *Tuberculin R.* (Koch) used for treatment only, the following forms (*Extra Pharmacopeia* p. 875) have been placed on the market by the manufacturers of Koch's tuberculins:

'*T. O. A. i. e.*, *Tuberculin-original-Alt.* (Alt. =old.)' A germ-free tubercle-bacilli-bouillon resulting from filtering fully-grown nutrient cultures of bacilli (*typus humanus*). In 1 and 5 cc. bottles.

'*P. T. O.' i. e.*, *Perlsucht-tuberculin-original.* (Perl-sucht,=Pearl disease, i. e., tuberculosis of serous membrane of cattle producing pearly nodules or tumours often pendulous). Is exactly like the above except-

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\*From the *Extra Pharmacopeia*.

ing that it is prepared from the tubercle bacilli in cattle (*typus bovinus*).

*Vacuum-Tuberculin* is obtained by reducing 'T. O. A.' at a low temperature and in partial vacuum to one-tenth of its volume. It differs from the old tuberculin in that old tuberculin is strongly *heated*. It consists of toxins produced by the bacilli during their cultivation. Old tuberculin, on the other hand, contains, in addition to toxins, endotoxines extracted from the bacilli at higher temperatures. It is sold in 1 and 5 cc. bottles.

*Bovine-Vacuum-Tuberculin* corresponds to vacuum-tuberculin last mentioned excepting that bovine bacilli are used. In 1 and 5 cc. bottles.

These vacuum preparations are introduced on account of their better keeping qualities.

New Bovine Tuberculin (Tuberculin P. T. R.) is equivalent to T. R. excepting that bacilli *typus bovinus* are used.

*Procedure and dosage.*

These are exclusively for treatment of patients exhibiting a very violent reaction to old-tuberculin or other similar preparation, as well as for treatment of those with a permanent or intermittent febrile temperature and not for diagnosis.

Dilute 1 cc. of any one of the above with 9 cc. 0.5 per cent. phenol. The manufacturers term this 10 cc. of vacuum tuberculin, bovine-vacuum-tuberculin dilution, or tuberculin dilution 1; the 10 cc. of 'T. O. A.' or 'P. T. O.' dilution, '*tuberculin dilution 2*'.

If 1 cc. of tuberculin dilution 1, made from vacuum tuberculin or bovine-vacuum-tuberculin, be further diluted with 9 cc. 0.5 per cent. phenol solution, '*tuberculin dilution 2*' is obtained, and by dilution of the '*tuberculin dilution 2*' from 'T. O. A.' or 'P. T. O.', '*tuberculin dilution 3*' is obtained, etc.

The different dilutions compare as follows:

Each 1 cc. 'T. O. A.' or 'P. T. O.' corresponds to 1 cc. '*tuberculin dilution 1*' (because vacuum and bovine-vacuum tuberculin are concentrated 10 times strength of 'T. O. A.' and 'P. T. O.').

It is intended that the physician should by trial injections select for each case the preparation most suited. Commence with 1 cc. of a '*tuberculin dilution 5*,' i. e., with 0.0001 cc. 'T. O. A.' or 'P. T. O.', or 0.00001 cc. vacuum or bovine-vacuum-tuberculin. If no marked reaction appears continue with the stronger preparation, No. 4, and so on.

If the reaction be violent even from this small dose, after a few days' interval, the trial is repeated with one of the other preparations.

In the course of the treatment as a rule no change is made in the preparation employed, but frequently patients with great sensitiveness lose it in the course of treatment and it is then advantageous to continue the treatment with the more active preparations, old tuberculin, bovine-tuberculin, or with tuberculin 'T. R.' or with bacilli emulsion (q. v.).

*Behring's Tulase*.—A clear liquid of honey consistence, said to contain all the constituents of the Koch bacillus. Used subcutaneously, intravenously or *per os*. The *British Medical Journal*, however, says, that the application of this cure is complicated.

*Tulase-Lactin* is tulase with milk intended to immunize infants. Behring himself speaks against too much reliance on its curative properties.

**Validol.**

Neustätter advises the internal use of this agent in 20-drop doses for scotoma scintillans (q. v.).

# CHAPTER VIII.

## THE USE OF ELECTRICITY IN OPHTHALMIC PRACTICE.

BY W. FRANKLIN COLEMAN, M. D., CHICAGO.

*Galvanism — Electrical Measurements — Electrolysis — Cataphoresis—  
Measure of Currents—Faradic Current—Magnetism—Electromag-  
net—High Frequency Current—Sinusoidal Machine—Static Machine  
—X-ray Apparatus—Lamps—Voltage—Amperage—Electric Dosage  
—Nerve Stimulation—Trophic Effects—The Ionic Theory—Inter-  
polar Action—Electrotherapy—Anesthesia by Cataphoresis—The  
Retinal Circulation Under Galvanic Stimulation—Home Treatment  
with Electrical Apparatus.*

Thales, a noble of Greece (640-546 B. C.), observed that amber (Elektron) when rubbed attracts and repels certain bodies; and, be- hold, in 1908, wireless telgraphy, the telephone, electric lighting, heat- ing and therapeutics. Dr. Gilbert, England (1540-1603 A. D.), corre- lated the observations of the ancients and founded a science he named "Electricity."

Electricity is probably a mode of motion of the universal ether. Hitz, in 1888, demonstrated that the waves, while larger than those of light, have similar properties of reflection, refraction and polarization. Lord Kelvin and Clerk Maxwell considered light an electrical wave. The unity of all forms of electricity is shown by the production of heat and chemical reaction, while the various physical and physiological phenomena depend chiefly upon the mode of production of the current; the voltage and amperage; the form of the current, primary, second- ary or static; and the frequency of the interruptions. We will con- sider briefly the electrical energies used in medicine: Galvanic, Far- adic, Sinusoidal, Electro-Static, High Frequency, Roentgen Rays and Light."

### **Galvanism.**

The galvanic, direct or continuous current flows without interrup- tion in one direction. It is furnished, when available, by the direct current dynamo used in street lighting or by a battery of chemical cells. The usual and best galvanic cells for a portable battery consist of ele- ments of zinc and carbon excited by a solution of sodium bichromate and sulphuric acid. For office work, LeClanche cells of zinc and carbon, in a solution of ammonium chloride, are much more durable

and satisfactory. The chemical production of zinc chloride at the zinc plate produces an electrical current, which flows from thence to the carbon and through the external circuit of cords and patient back to the zinc. The cord attached to the carbon is therefore + positive, or anode; and the one attached to the zinc—, negative, or cathode.

### Electrical Measurements.

These refer to pressure, resistance and current. The unit of pressure or electromotor force is the volt. Voltage is the force produced by chemical or physical means, which generates or tends to generate a current of electricity by forcing it through a conductor. This is analogous to the generation of heat at one end of a rod, which is forced to the opposite end.

The Ohm is the unit of resistance, which, electrically, signifies obstruction to transmission and is analogous to the resistance of the propagation of light and heat. Resistance may equally well be considered the capacity for conduction.

The unit of current is the Ampère, which is a measure of the force or intensity of the current exerted, e. g., on the magnetic pole of a galvanometer. The quantity of the current is the product of the intensity by the time of flow. From the above measurements, Ohm's law is expressed thus:

$$\frac{E\text{—Electromotive force}}{R\text{—Resistance}} = C\text{—Current}$$

or

$$\frac{1 \text{ Volt}}{1 \text{ Ohm}} = 1 \text{ Ampère}$$

That is, the current varies directly as the voltage, and indirectly as the resistance.

### Electrolysis.

Electrolysis is the decomposition of a fluid by an electrical current and the products are called *ions*. Some of these ions are left at the anode (anions), others are carried to the cathode (cations). O., Acids, I. Cl. are Anions. The metallic bases and H. are cations.

### Cataphoresis.

Cataphoresis is so evidently an electrolytic process that it scarcely deserves a separate designation. In general, bases remain on or are carried to the cathode, (cataphoresis) and acids and the halogens Br. I. and Cl. to the anode, (anophoresis). Hence, in cocaine anesthesia, the solution is applied by the + sponge, while an iodine solution is applied by the negative.

**Control of Currents.**

The direct street current for medical use is controlled by a graphite or wire rheostat and measured by a meter graduated in milliampères.

**Rheostat.**

Fig. 2.

a-a: represent supply wires coming from a battery of cells, direct current dynamo, or the commercial 110 volt direct current.

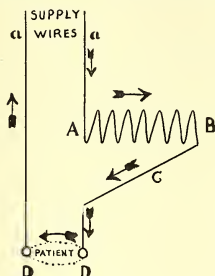
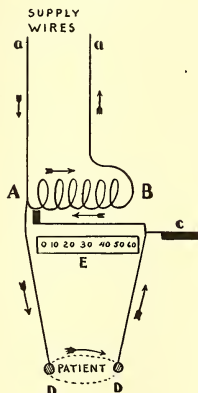


Fig. 1.



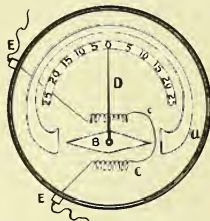
(See Fig. 1.)

A-B: illustrates the resistance of the rheostat. The arrows indicate the direction of the current.

C: a sliding lever which may be moved from right to left.



D-D: binding posts through which the current is passed to the patient by cords and electrodes. The left supply wire "a" is connected directly to left binding post "D." The right supply wire is attached to one end of the rheostat and the current must pass through the same to sliding lever "C" before reaching the patient. If the resistance of the rheostat is great enough, no current will pass to the patient while C is at B. A current is secured and increasingly if C be moved to-



ward A to lessen the resistance. The pressure of E. M. F. remains the same, i. e., if the supply wires have a pressure of 110 volts so will the entire circuit, including patient.

Recently an improvement has been made in apparatus termed a voltmeter, whereby the current is controlled by regulating the voltage.

Fig. 3.



Fig. 4.

This has the advantage of giving a current of, say, 5 m. a. under a low pressure, e. g., 15-20 volts, which causes less discomfort than a similar current under high pressure, 110 volts, with a rheostat control. (See Fig. 2.)

a-a represent the supply wires.

A-B resistance or rheostat. It will be observed that the rheostat is connected directly to the supply wires "a-a."

D-D binding posts for patient.

E., volt scale, showing the increase of voltage as lever "C" is moved to right. By this principle, we increase current flow by increasing voltage, the factor which overcomes resistance. It is almost

essential to control voltage in administering direct (galvanic) currents to the eye.

#### Measure of Currents.

When an electric current passes along a conductor parallel to a magnetic needle, the needle tends to place itself at right angles to the current, (see Fig. 5) e. g. The milliampere meter consists of a cur-

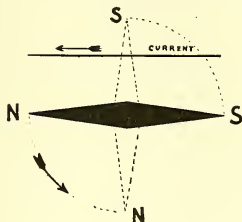


Fig. 5.

rent carrying wire wound around a frame with an indicating needle, which rotates around a fixed magnet. (See Fig. 3, p. 136).

#### The Faradic Current.

This is an induced current which applies to the coil on the galvano-faradic wall plate, the Rhumkorff coil of the high frequency machine and the alternating (sinusoidal) current dynamo. Faraday, in 1831, discovered that a magnet, while either entering or withdrawing from a coil of wire, (closed circuit) causes an induced current in the coil. Further, if two circuits are placed near each other, and a current (primary) be passed through one, the circuit, which is made and broken, causes an induced (secondary) current in the other. From this it follows that a current flowing with a uniform intensity, through the primary, will not induce a current in the secondary wire; but, any increase or decrease of the current, by any means in the primary, will produce a current in the secondary. The strength of the induced current increases with the strength and frequency of the interruptions in the primary, and, with the length of the wire in the coils. All induced currents are electro-magnetic.

#### Magnetism.

If iron filings be scattered over a piece of paper held over a bar magnet, they arrange themselves as lines of force. These "lines of force" are conceived as entering the S pole and emerging from the N. The magnetic *field* is made up of these lines. (See Fig. 6.)

**The Electromagnet.**

This is made by passing a current through a coil of insulated copper wire wound around a core of soft iron. A magnet strongly attracts iron, nickel and cobalt. Unlike poles, as N and S, attract. Like poles repel each other. When an electric current passes through a

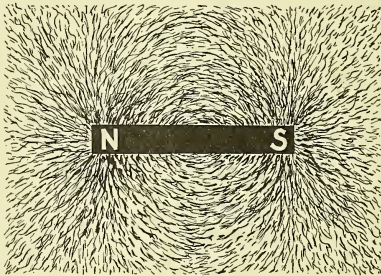


Fig. 6.

wire, magnetic lines of force are always formed, which encircle the wire at right angles; and, if a magnetic needle be brought near, it will tend to place itself parallel to the lines, that is at right angles to the current as shown in the milliamper meter. (See Fig. 3, p. 136).

**The Faradic or Induction Coil.**

It generally consists of a *primary* coil of short, thick, insulated copper wire around a core of soft iron wires, and a *secondary* coil, of



Fig. 7.

longer, thin insulated wire, wound around the primary. The interrupter is an iron hammer in contact with a set screw, near the core of the primary. A current through the hammer and primary circuit magnetises the core, which attracts the hammer, and thus breaks the current, when the core is then demagnetised and the hammer springs back to again complete the circuit. At each make and break of the

circuit, the current alternates or reverses its direction. When the circuit in the primary is closed, the current in the secondary is in the opposite direction to that in the primary; when it is opened, the current in the secondary is in the same direction. Hence the strength of the current is much greater at the break (open) than at the make (closed). (Figs. 11 and 12, p. 146).

#### **High Frequency, Induction or Rhumkorff Coil.**

This is the faradic on a large scale, with the addition of a condenser; mercury jet, or electrolytic interruptor, and Leyden jars. The disruptive discharge from the prime conductor of a static machine or Rhumkorff coil, or from the spark terminals of the Leyden jars, consists of a series of discharges of rapid isochronous oscillations, reaching often to hundreds of millions per second and these waves rapidly die down. (See Fig. 4.)

It might be well to define high frequency currents, those in which the oscillations reach a million or over per second. The making of the circuit in the primary coil not only induces a current in the secondary, but a reverse current of self induction in the primary, which weakens the current. The condenser absorbs this self-induced current and discharges it at the break, suddenly demagnetising the core and adding to the efficiency of the coil.

The condenser consists of attached layers of tin foil, separated by paraffined parchment.

#### *The interruptor.*

For the direct current either the mercury turbine, *or the electrolytic may be employed.* With the alternating current, the electrolytic is used. The mercury turbine is not satisfactory.

#### **The Oudin D'Arsonval Resonator.**

The purpose of this usual addition to the coil is to increase by self induction extra currents which add enormously to the alternations of frequency to the current, and capacity of the coil. The first portion consists of two rods, terminating in balls, (spark terminals). The rods are connected with the + (positive) and — (negative) terminals of Leyden jars, each of which by induction produces an opposite charge on the outer wall. The outside of the jars are connected with a coarse coil, (solenoid) wound around the lower end of a drum, and continuous with a fine wire coil around the upper end (resonator). As the jars are charged with sufficient force to overcome the resistance of the air gap, a spark passes between the rods and empties the jars. The charge on the outer walls being released rushes through the conductors to the solenoid, causing vibrations in it and synchronous *resonance* in the upper helix, (resonator). A *condenser*

called an *auto-condensation couch* may be put in the circuit to increase the dosage to the patient and facilitate the application.

### The Alternating Current Dynamo or Sinusoidal Machine.

The dynamo is made up of a horse-shoe-shaped electromagnet, with an armature which rotates placed between the poles of the magnet. The direct street current energises the primary coil of the magnet; forming magnetic lines of force that flow through the magnet from the S to the N pole and then the armature to complete the circuit. The current alternates or reverses its direction as the armature in its revolution presents its opposite ends to the poles of the magnet. (See Fig. 12.)

N. S. represents the magnet and A. B. the armature, with the flux as represented SNAB. By a semi-revolution of the armature A is opposite S and the flow is reversed in the armature to BA. Brushes collect the current from the revolving armature for the external circuit to the patient. The speed of the revolutions is regulated by a

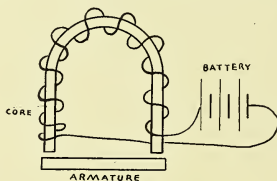


Fig. 8.

rheostat and the strength of the current by another or better by a volt graduator.

### The Static or Influence Machine.

A static charge implies electricity at rest on the surface of a body. Franklin's theory, now modified, was that all bodies possess a certain amount of electricity, and friction produces two dissimilar simultaneous electrical states, positive and negative. If various bodies be rubbed some will be charged with positive and others with negative electricity, and in all cases the rubber is charged equally with and oppositely to the body rubbed. All objects may be electrified by friction, and the charge remains on non-conductors, such as glass. It may be discharged by passing into and along a conductor, usually metallic. Oppositely charged bodies attract and similarly charged repel each other. If an insulated uncharged body be brought in to the vicinity of a charged, it is charged by influence or electro-static induction. If a positively charged body be placed *near* an uncharged one, the former will repel

the positive electricity of the latter to its far side, leaving the negative on its near side.

If a conductor be placed in contact with the influenced body, the free positive charge will escape, and the *bound* or attracted negative will remain.

A positively charged body brought *in contact with* an uncharged one gives it a positive charge. We may suppose that the negative charge induced in the latter by the approach of the former, (positive) is neutralized by contact, leaving a positive induced charge on the latter. When two near bodies are sufficiently and oppositely charged, visible lines pass by stress from the higher potential to the lower negative, e. g., between the poles of a static machine or coil. Upon these elementary principles depend the phenomena of the static machine.

#### The X-Ray, Crookes' or Focus Tube.

X-rays are composed of infinitesimally short transverse waves propagated in straight diverging lines, their mass being inversely as

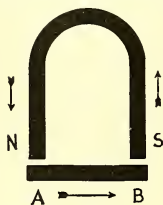


Fig. 9.

the square of the distance. They are produced in a Crookes' tube having a vacuum of .000001 of an atmosphere which is traversed by a high tension electrical current of a static machine or Rhumkorff coil. The tube has a cupped cathode and two anodes, one of which in line with the cathode is the anode proper. The other terminates in a flat disc (target), the anticathode. In connecting up the tube, the anode of the exciting machine should be connected with the anode of the tube, and not with the anti-cathode, as is often recommended.

#### Theory of the Production of X-Rays.

A stream of particles probably H (Guilleminot) flows from all parts of the anode end of the tube towards the cathode, receives a negative charge, is then repelled with tremendous velocity and focused upon the anti-cathode, by which it is transformed into X-rays, which are ejected through the wall of the tube in front of the target. The auxiliary chamber of the tube contains a mica disc, which, when heated

by connection with the cathode cord, gives off vapor and lowers the tube. The vacuum is raised by connecting the anode cord to the platinum coil, which being heated, absorbs gas. A satisfactory tube should show a dull spot at or near the center of the target, when used, and it should be possible to raise its vacuum in five to ten minutes, and lower it in a few seconds to five minutes.

### **Lamps.**

The incandescent, open arc, and Nernst lamps may be excited by the direct or alternating current. The incandescent and open arc take either 110 or 220 volts, according to their resistance. The Nernst requires 220 volts, and when 110 only is available, it will be necessary to raise the potential to 220.

The Nernst light, furnished by a rod of zirconia, can be used with or without a glass globe.

Light consists of diverging radiations of the ether which vibrate transversely. It can be separated by a prism into seven lights of various refrangibility from violet with the highest, decreasing in indigo, blue, green, yellow, orange, to red—the lowest. Above the visible spectrum there are ultraviolet waves and below the red there are infra red.

Light contains *luminous*, *thermic* and *chemical* properties. The light is most intense in the yellow part of the spectrum, and least in the violet. The heat is greatest in the red and infra red, and the chemical or actinic rays in the violet and ultra-violet. The therapeutic lamps chiefly in use are the open arc and the incandescent of 50 to 500 C. P. The Nernst lamp is largely used in electric lighting. The ultra-violet chemical rays, which are furnished in largest quantity by the open arc light, are nearly all intercepted by the globe of the incandescent lamp. As the Nernst light supplies a large amount of chemical rays and more light rays (with a similar current) than the incandescent and can be used with or without a globe and is inexpensive in first cost, it deserves to be generally introduced for therapeutic use.

### **Some of the Physical Characteristics of the Preceding Energies.** **Galvanism.**

The current flows uninterruptedly in one direction. The voltage required is comparatively low (50) but the milliamperage furnished and sometimes applied is very high (250 m.a.). It produces chemical or electrolytic, thermal and magnetic effects. When interrupted, it still, intermittently, causes electrolysis. If metal electrodes be placed in a solution of salts marked polar effects are shown. O, acids, I, Cl, Br. appear at the positive pole; H and bases (alkalies) at the negative. The galvanic current is highly electrolytic, in contrast with the



negligible amount of chemical decomposition by the faradic, high frequency or static.

Whether a current is electrolytic or not is of vital interest in electro-therapeutics. Authors and electricians have maintained that the alternating current (sinusoidal) is not electrolytic. The writer ventured to teach during the past seven years that it is, with which theory Dr. G. Gordon Burdick only has agreed. Two years ago Guilleminot wrote, "Experiments, both physical and physiological, by various scientists, have demonstrated the electrolytic action of the sinusoidal current." He believes the ionic changes in the tissues produced by the sinusoidal current are comparable with those of the galvanic.

#### **Voltage.**

The street service furnishes 110 volts to the galvanic wall plate and to the alternating dynamo. The A. C. dynamo we use gives a voltage of 70-80. The high frequency coil and static machine supply an enormous voltage, yielding 25,000 to 50,000 volts when an air spark gap of one inch is overcome and 600,000 for a 12 inch gap of the usual coil or good static machine.

#### **Amperage.**

The amperage of the galvanic and sinusoidal currents is very high compared with the voltage. That of the static is infinitesimal, .001 m. a. The strength of the alternating current may be estimated by applying the same voltage to the same patient, as applied by the galvanic current. When the latter reads, say, 5 m. a., the former with a similar voltage and resistance gives also 5 m. a. The amperage of the resonator and auto-condensation couch excited by a coil is estimated to be as high as 350 m. a. Theoretically the current can be measured by a hot wire meter, but a reliable one is still a desideratum.

#### **Polarity.**

The construction of the large coil gives it a distinct polarity which is also characteristic of the static machine. The coil of the wall plate and the alternating machine produces an alternating polarity at the electrodes with each reversal of the current. The positive becoming negative and negative positive.

#### **Regulation of the Direct and the Alternating Current Dosage.**

With a voltage of 110 and the resistance of the patient in the circuit a m. a., of say 5 may be obtained, either by lowering the voltage with a volt graduator or increasing the resistance with a rheostat. As the high voltage or tension of the latter causes more pain than the lower of the former, it is better to use the volt graduator, which is also more durable and reliable.

**Meters.**

Those of recent make are generally accurate, but they should be tested in series with a standard meter before using them to measure such small doses as the eye often requires.

**Some of the Physiological Effects of the Various Modalities.**

We will consider the results which are, in quality, common to various currents and light, and then refer to special effects.

**Trophic Changes.**

High frequency treatments by auto-conduction and auto-condensation; static baths given by connecting the patient with the active pole and grounding the other; sinusoidal currents and electric light baths increase the respiratory capacity of the blood, by promoting the absorption of O and the elimination of  $\text{CO}_2$ . The pulse is accelerated and arterial tension lowered. Urea, uric acid, phosphates, sulphates and chlorides increase, metabolism and absorption are promoted and

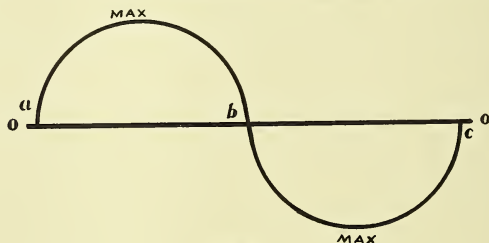


Fig. 10.

local and general nutrition favored; anesthetic effects are produced and there is a tendency to sleep.

The currents excite voluntary (striped) and involuntary (un-striped) muscular fibres to contract, thus increasing the vaso-motor circulation and body weight.

**Faradic Current.**

The physiological results are due to *local gymnastic action* on muscles (Debetat) which increases muscle growth. Twenty treatments, of four minutes each, increased the weight of the femoral of an animal 50 per cent. Prolonged application diminishes weight and permanently contracts (tetanises) the muscles, and, when extreme, results in atrophy. The tetanised muscle, when fatigued, finally relaxes. A muscle is tetanised and no longer responds when the interruptions exceed 10,000 per second. The action of the faradic current on the nervous system is very slight and the muscular contractions it produces are painful.

### High Frequency Currents.

The patient is unconscious of any sensation or muscular contraction, the vibrations being too high (above 10,000 per second) to excite sensory or motor reaction. That the current passes through the body d'Arsonval demonstrated by passing a current through a saline solution in a cylinder and finding it as strong at the center as at the periphery. The trophic changes produced by the high frequency current of the induction coil are greater than by the static machine (Guilleminot). This is probably due to the greater amperage of the coil, for ionisation is proportional to amperage. The facility of application (by the couch) and the comfort of the patient make this current very desirable for general and special use.

Sparking causes muscular contraction, rise of blood pressure and anemia, followed by relaxation, fall of pressure and hyperemia.

The  $\text{CO}_2$  of respiration is increased 100 per cent. and heat nearly doubled by this current (d'Arsonval). Those who use the static machine only, generally suppose the coil cannot give a head breeze or muscular contraction (Morton Wave) current. The former is furnished by an arm, when attached to the top of the resonator, giving a stronger spark but less aura than the static. It is true the make and break of the *interruptor* furnished with the coil are too rapid to produce muscular contraction. Two years ago, the writer wished to produce a muscular contraction current from the coil to excite the tensor tympani and at the same time a current of amperage to the auditory nerve tract. A *mercury dip* interruptor and a graphite rheostat to control its speed were obtained and connected, when required, with the coil circuit, the jet interruptor being switched off. This has given ideal Morton wave contractions and in some cases of chronic deafness phenomenal results. Later we learned that Dr. Gordon Burdick devised and used this interruptor.

### Dosage.

There appears to be no limit to the tolerance of this current if the interruptions be sufficiently high. Tesla, with his body in the circuit, lighted ten 16 C. F. lamps which require five amperes of current. With 1-3 of an ampere a galvanic current may kill a man. We have only a theoretical knowledge of the static machine, which undoubtedly possesses characteristic advantages, but we prefer the coil for the following reasons: It occupies little space, requires little care, works well in all weather, never changes its polarity and furnishes amperage to charge an auto-condensation couch. There is no question of the greater utility of the coil in radiography and it causes greater trophic

effects. With a mercury dip interruptor it apparently can produce all the physical and physiological effects of the static current.

#### The Static or Influence Machine.

If the active electrode be applied to the body and the patient grounded contractions of the voluntary and involuntary muscles occur, which are deep, energetic and painless. The spark light kills all kinds of bacteria on the surface in a few minutes. The head breeze has a very sedative action and calms pain. We cannot agree with Guilleminot that "The spark produces on the optic nerve the same effect as other nerve stimulants," e. g., the sinusoidal and galvanic currents,



Fig. 11—This is the tracing made from a du Bois-Reymond coil very rapidly interrupted. The first oblique line below the horizontal represents the make, and the following line (crossing the horizontal) the break (or stronger current).—(Kellogg.)



Fig. 12—This tracing represents the current from Faradic Apparatus.—(McIntosh.) A, make; B, break.—(Kellogg.)

since it produces no phosphenes. The other effects of the static are similar to those of the coil.

#### The Sinusoidal Current. (See Fig. 10.)

During each half revolution of the armature the wave gradually and continuously rises from zero to maximum, and returns to zero; then, without interruption, reverses and rises to maximum and returns to zero. Hence this is a continuous current. The ionic action is greater when the alternations are slow. The writer we believe was the first (1901) to treat the eye with an alternating current. A few experiments demonstrated that it possesses remarkable electrolytic properties and a special action on the nerves of special sensation. If two copper terminals of the current be brought in contact with a piece of meat disintegrated copper will be disseminated *through* the tissue from pole to pole, while, with the galvanic current, the copper chloride appears

only near the positive. This superior interpolary action suggests a trial of the alternating current even in cases with pathological exudates.

### **Nerve Stimulation.**

Holmgren (1866) demonstrated that light is transformed in the eye (probably in the rods and cones), into an electrical conduction current. This suggestion for electrical stimulation has been long in coming into its own. The response of a nerve to stimulation is manifested by its special function. The faradic, high frequency or static current, or X-ray applied to the eye, *produces no light sensation*. The galvanic current, especially if interrupted, causes a moderate interrupted flash with a painful sensation. The sinusoidal current, with a similar voltage, say 15, gives a constant brilliant variegated mosaic flash without any discomfort. For the above reasons we use no other current in optic atrophy, primary or secondary.

### **The Galvanic Current.**

It is distinguished by the opposite chemical and nerve effects produced at the anode and cathode. At the anode, *the acid reaction* tends to coagulate the blood, checks bleeding, hardens the tissues and in sufficient quantity cauterises. The anode is also a vaso constrictor and a sedative. The cathode excites an *alkaline reaction*, tends to liquefy tissue and in a caustic dose produces a soft cicatrix. It is a vasodilator producing hyperemia, hyperaesthesia and an increase of bleeding.

The smaller the active electrode the more the lines of flux are concentrated in the tissues.

### **Trophic Effects.**

D'Arsonval found galvanism has no effect on the respiratory capacity of the blood, on the amount of urea or heat production.

### **Electrolysis.**

Certain solutions, which contain an acid, base or salt, conduct electricity and are decomposed by it.

### **The Ionic Theory.**

The molecule is the smallest subdivision of a substance that does not alter its identity. The molecules of a salt, acid or base, become dissociated in the process of solution into two ions, one having an anode and one a cathode charge quite independent of any external electric influence. If the two terminals of an electric circuit be put in the solution the negative ions will be carried to the positive pole and the positive ions to the negative. The electric current is the traveling of the negatively charged ions (called anions), to the anode pole and the positively charged (cations) to the cathode.

**Interpolar Action.**

The classical experiment of Leduc showed that ions are carried into the body. By applying a solution of strychnia, (a base which travels to the negative) on the positive electrode to a rabbit in the

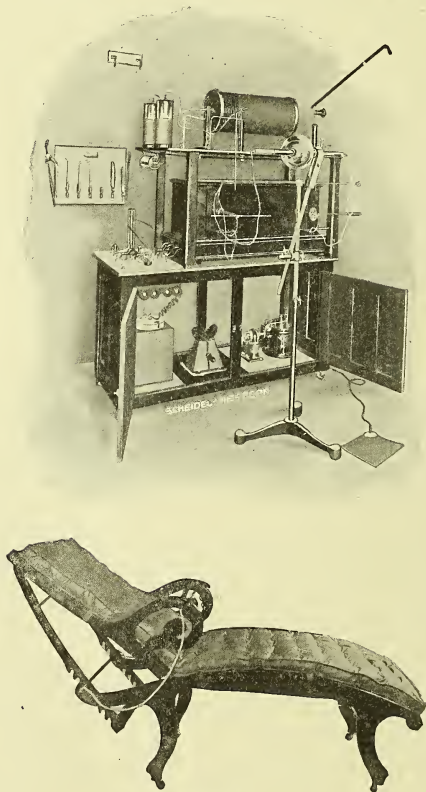


Fig. 13.

circuit the animal died in tetanic convulsions. Applied on the negative pole it had no effect. Again potassium cyanide, (*the acid traveling to the positive*) on the negative, killed an animal suddenly showing



symptoms of hydrocyanic poisoning. Applied, on the positive, the result was negative.

### Conduction.

In conduction through the body Na Cl plays the most important part of any of the salts. While applying galvanism the initial current rises 50 to 100 per cent. in five to ten minutes. As the voltage is constant, this must be due to a lowering of the resistance of the body or the machine. Heat increases the resistance of metals and lowers it in graphite and fluids. With the low amperage, (5 to 10) the heating of the machine is negligible. The resistance of the body decreases

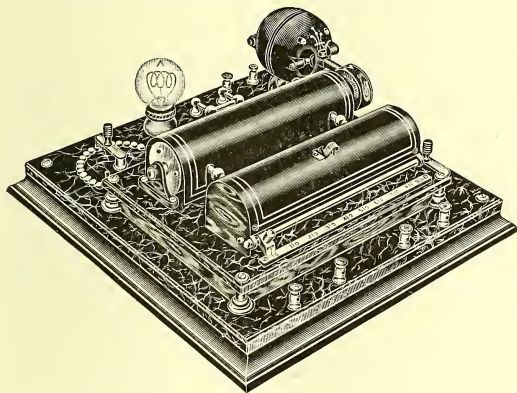


Fig. 14—This machine furnishes a slow sinusoidal; a rapid sinusoidal; and a combination of the slow and the rapid (the multiplex current); and a galvanic current. The advantage of this multiplex current is that cell stimulation is obtained at the same time that the voluntary and involuntary muscles are being exercised. We have not experienced with any other current such remarkably strong muscular contractions, unaccompanied by pain, as this current produces. The machine seems to us to furnish a new electric wave energy, destined to add much to the efficacy of electro-therapeutics.

until ionisation is complete. From this we may suppose the separation of the molecules of the blood by heating leaves more room for the free circulation of the ions.

While using the H. F. current the intensity markedly decreases. The large amperage very sensibly heats the metallic rheostat and thereby increases the resistance and lowers the current. Of the body tissues the nerve offers the least resistance to a current and the skin the greatest. *Effect on the nervous system*—The pricking, burning and pain may be prevented by gradually increasing the current. The stimula-



tion of the nervous centers is due to the ready conduction of the current by the nerve fibres, (their chief function) to the nutritive vessels of the neurilemma and to the trophic center—the cell body (neuron). Thus nerve nutrition is promoted by increased vascularity and direct cell stimulation. As the functional specialisation of a nerve fibre alone depends upon its connection with a nerve center the greater nutritional effect of the stimulation of the *center also* by an electrical current, as compared with the *vasomotor effect* only of vibratory massage, can be appreciated.

*Muscular contractions* may be excited by applying the current directly to the muscle or to its motor nerve. As a degenerated nerve and muscle respond to a galvanic current, (especially when inter-

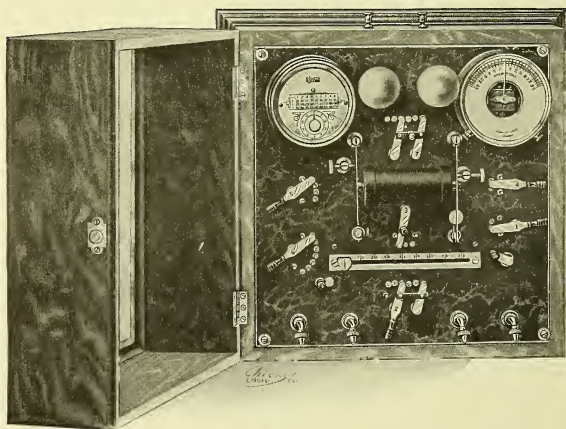


Fig. 15.

rupted) after they cease to react to a faradic, and the former also acts on the nerve center, we always use this in paresis or paralysis.

### **Roentgen Rays.**

The X-ray is a stimulant, which, in moderation, causes hyperemia; and in excess, necrosis. The greatest effect of the radiation is at the terminus of the penetration, the degree of which, other things being equal, is proportional to the vacuum of the tube. The body cells are supposed to absorb the rays and fluorescence and chemical reaction follow. Radiation increases cell growth, leucocytosis and phagocytosis. It causes the disintegration and absorption of such low resisting tis-

sues as epithelioma, sarcoma, etc. C. E. Ochsner observes that exposures at first greatly increase the vascularity of the tissues, while, under continued treatment, they become ischemic and brittle.

#### Dosage.

The factors which enter into the dosage are:

- 1—Vacuum of the tube,
- 2—Degree of fluorescence (Grubbe),

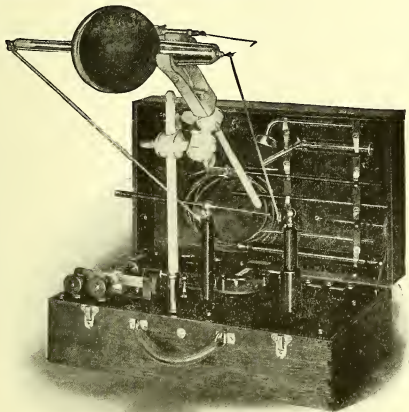


Fig. 16—From this outfit can be obtained all of the modalities delivered by the large Rühmkorff coil except the ultraviolet light. However, it is not possible to transform as great a volume of energy in the small outfit, but there is sufficient for local application with vacuum electrodes, local D'Arsonvalization, effluve, spark, etc. The small outfit also gives satisfactory results in X-Ray work, and it possesses the advantage that it can be taken to the patient's bedside, and for the above work is comparatively inexpensive. The advantage of the office cabinet is that it furnishes large amperage for general D'Arsonvalization, and for the auto-condensation couch and for auto-conduction.

- 3—Distance of patient from tube,
  - 4—Time of exposure,
  - 5—Frequency.
- 1—The vacuum of the tube and penetration of the rays are in direct ratio to the length of the spark gap. A tube is low when its resistance forces a spark one to three inches only between the prime conductors: medium, three to five; and high above five.
  - 2—Grubbe alone regards this factor and recommends the faintest visible light in the tube. By this the dosage may be more uni-

formly regulated, for a high brilliancy occurs through a much greater range of voltage.

- 3—A working rule is to place the patient two inches further from the tube than the length of the spark gap.
- 4—Eight to ten minutes with the coil; 10 to 12 with the static. As the effect is cumulative the first symptoms of redness may appear at the first up to the end of four weeks' treatment (Codman's table—Pusey) therefore the frequency should progressively lessen, say daily for two weeks, then tri-weekly.
- 5—Where itching, burning, redness, swelling, pigmentation, blanching or looseness of the hairs appears, discontinue the raying until recovery, unless dermatitis be desired. The depth of the tissue to be treated will indicate the regulation of the spark gap, e. g., two inches for the lids and surface of the globe; three to five for intraocular and orbital tissues. While the spark gap indicates the initial vacuum of the tube this can be maintained only by placing the wire regulator at the desired distance from the cathode end of the tube, thus preventing the rising of the vacuum due to the dissipation of the tube content, either in or through the wall of the tube or upon the walls of the electrodes. A serious X-ray burn unless due to idiosyncrasy, which no fellow can predicate, should be a terror of the past.

#### **Appliances.**

We use the Victor transformer No. 2 with a voltmeter, in the application of the sinusoidal current (Fig. 17) and the Victor galvanic and faradic wall plate, which contains a voltmeter. (Fig. 15). Our H. F. coil and auto-condensation couch were made by the Western X-Ray & Coil Co. (Chicago).

The large magnet was "made in Germany." Many equally good magnets are now made in America and quite as reasonably.

The 500 C. P. lamp was made by Rogers (Chicago) and a 50 C. P. by the Victor Company.

#### *New Electrical Apparatus.*

The following have lately come to our notice and deserve mention. A portable apparatus for generating X-ray, sinusoidal, galvanic and H. F. currents made by the Victor Co., Chicago (Fig. 16), and a small water motor generator (sinusoidal current) made by the Rochester Electric Specialty Co. (It is said to give a voltage of 12-38 with 20-50 m. a. of current.

The whole machine is a small object about 4x6 inches. When attached to a water faucet, the motor can be made to revolve (according to the regulations of the stop-cock) from 2500-10000 per minute. It

furnishes a mild current to one that cannot be tolerated by the hands. Slow revolutions produce a brilliant light flash. It is a genuine *mutum in parvo* and has a field for the treatment of the eye, etc., in houses which have not an electric light supply.

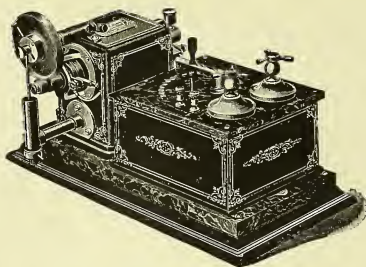
Also the Victor Multiplex Sinusoidal outfit. (See Fig. 14).

### **Phototherapy.**

Gebhard photographed through the body with red light. The rate of vibration of light rays is interpreted by the eye in terms of color: 481 billions per second are called red, and 764 billions violet. Light stimulates surface circulation, metabolism, absorption, general and local nutrition, and perhaps relieves pain more than any other energy.

Electrical, X-ray and light energies are bactericidal on the surface by the oxidising action of free O, which does not exist deeply in the tissues. These energies, by increasing the oxygenation of the blood and nutritive and cellular changes, promote physiological resistance to the growth and increase of bacteria, but they are not directly bactericidal in the body. The ultra violet rays are the greatest in their bactericidal power, and the excitation of tissue reaction, but the blue, violet and longer wave lengths are capable of greater penetration. The complex of white light and ultra-violet has most therapeutic value (Cleaves). The open arc lamp seems to be the most used in the East, while the 50 to 500 C. P. incandescent lamps are the ones most used in the West.

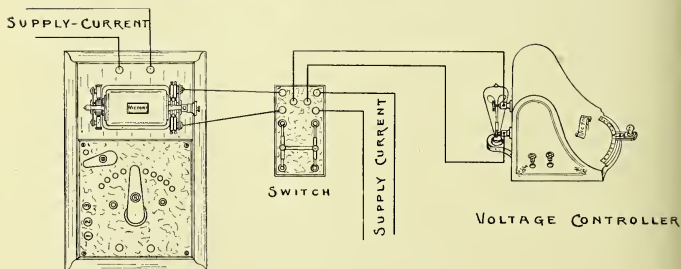
That the use of electricity in ophthalmic practice has received comparatively little attention is much in evidence in the text books, and the programs of the Ophthalmic Section of the A. M. A., in which for several years (with two papers excepted) the subject has received no consideration (Bulson). No remedy, drug or other has been shown to produce so manifold physiological results as electricity, and no combination of drugs has caused so phenomenal a restoration of degenerated and infiltrated tissue to normal structure and function. The *modus operandi* of drugs is a sealed book compared with the demonstrated action of electricity, and yet, in these latter day myths, we read "The use of electricity in the treatment of neuropathic diseases does not in any instance rest on a scientific basis"; also: "In short we know, beyond question, that many of the results are purely psychic and we have no means of knowing that they are not all psychic." Psychic, indeed! Perhaps electrophysiological processes are wrought by the suggestion of the demonstrator. Perhaps also the restoration of a degenerated nerve tract to normal function is due to wireless thought transference, instead of electrical conduction. One further instance of a



No. 2. Transformer with Ear Pump.



Switch.



VICTOR No 2 TRANSFORMER

Fig. 17—This apparatus furnishes an alternating current, a cautery, an electric light, a motor with ear pump attachment, also if needed, a motor for a dental cable with burrs and drills; and a cable for vibratory massage. The direct street current can be used by means of the switch.

representative doubter. A patient with intraocular hemorrhage and light perception only, had been skillfully treated medically for three months without improvement. Galvanism *gradually* restored his vision to normal in the following three months. To this, one of the eight oculists consulted, replied: "Many coincidences do occur." Of all forms of electricity galvanism furnishes the greatest variety of useful application to the eye and general system, while with the possible exception of the X-ray, it requires the greatest skill for its successful application. For the most part we have used electricity in chronic diseases which are not amenable to drugs. This class will probably afford the largest field for electro-therapy, still there is great opportunity for its aid in acute cases, though the usual combination with drugs renders the share of electricity in the result doubtful.

In reporting the result of X-ray electric and light treatment we will select cases in which these agencies only have been used, or in which previous medication had so long proved unavailing as to leave little doubt that the benefit following the combination of electricity with drugs was due to the former. Our aim is to leave no ground for a reasonable doubt as to the identity of the benefactor.

In optic atrophy, etc., Erb applies the electrodes to the temples and reverses the current, then the negative to the closed lids and the positive to the nucha and finally the negative on the superior cervical ganglion and the positive on the nucha.

We have applied the negative pole (galv.) to the lids and positive to the nucha with 4-7 m. a. (usually 5) for 15 minutes daily. With the sinusoidal current (which has a constantly reversible polarity) one electrode was applied to the eye or eyes and the other to the nucha for 15 minutes daily.

As a transverse current through the head is more stimulating than a longitudinal and galvanization of the sympathetic has so important an influence on the eye, it is possible Erb's method might *have given* us better results.

The application of galvanism to the head may cause vomiting, pallor, syncope and capillary hemorrhages in the brain substance. (Jacoby).

The current affects the eye both directly and through reflex action from the fifth pair and the sympathetic (B. and R.). The light flash was known to Volta a century ago. Duchenne was the first to call general attention to this phenomenon. He applied the continuous current, from a Voltaic pile to the face of a patient suffering from paralysis of the portio dura. The victim exclaimed that the room was in a blaze and a total and permanent loss of sight followed.



Static and electromagnetic currents act slightly upon the retina. The faradic current, unless its tension is very high, can be made to affect it little if any (B. and R.).

We do not know the form of "Electromagnetic" referred to above, but the sinusoidal (or alternating) is electromagnetic and produces a flash unequaled by any other *current*. All the faradic that can be possibly tolerated on the head does not produce the slightest flash (C). When the positive pole is placed over or near the eye the flash is *blue* and when the negative is so placed it is *orange*. (B and R) Neg. also blue (C).

Since the appearance of light takes place by *reflex action* from the branches of the 5th to the retina, it is produced when the electrode touches any point supplied by the trigeminus. (B. and R.).

Holmgren's discovery in 1881 that light is transformed in the retina into an induction electrical current, demonstrates that a perception of light may, also, be produced by the direct stimulation of an electric current to the retina (C.).

*The Retinal Circulation Under Galvanic Stimulation.*

Roosa observed that the retinal arteries increased in size and more vessels were brought into view. Loring noticed a marked increase in the size of the veins. Hackley observed enlargement of both the arteries and veins.

*Caution.* Unlooked-for results by competent observers would indicate the great importance of referring our cases to none but experts in Roentgen therapy. (Ring).

*Home Treatments.* An oculist was advised to use the sinusoidal current, or in lieu of it the galvanic with no more than 5 m. a. of current in a case of incipient optic atrophy. He reported the patient insisted upon using galvanism himself at home and succeeded with a 30 m. a. (!) current in exciting a very serious choroiditis. The oculist is disappointed in the efficacy of electricity and the patient injured. *Verbum Sap.*

The diseases of the eye for which electricity has been used with more or less success, are paralysis of the muscles, asthenopia, retinal hyperaesthesia, amblyopia and amaurosis, spasm of the lids, ptosis, opacity of the cornea, photophobia, myosis and mydriasis and neuroretinitis. (B. and R.) 1871.

**Anesthesia by Cataphoresis.**

In a case of cardiac disease Ziegler applied (of course with the positive pole) a 20 per cent. solution of cocaine to the eye for 20 minutes and enucleated it without much discomfort to the patient.



## CHAPTER IX.

### ELECTROTHERAPY IN DISEASES OF THE OCULAR APPARATUS, CONTINUED.

*X-ray Treatment of Diseases of the Lids—Epithelioma—Naevi—Xanthoma—Electrocautery Treatment of Ectropion and Entropion—Trichiasis—Herpes Zoster—Trachoma—Spring Catarrh—Tuberculosis of Lids and Cornea—Phototherapy in Serpentine Ulcer—Electrocautery in Various Forms of Corneal Ulcer—Parenchymatous Keratitis—Keratoconus Treated by Electrocautery—Galvanic Current In Cataract—Episcleritis—Chorioretinitis—Detached Retina—Optic Atrophy—Amblyopia Ex Anopsia—Asthenopia—Frontal Headache—Glaucoma—Magnet Operations—Exophthalmic Goitre—Oculomotor Paresis and Paralysis—Lachrymal Stenosis—Supraorbital Neuralgia—Epiphora—Light Therapy.*

*Eye-lids.*—*Epithelioma.* Treatment by X-rays. In a considerable group several of which were inoperable, all recovered. (Ring). Mayou, Pusey, J. Green, Jr., C. L. Leonard and others report cures in all cases. There was no relapse in three years. (Pusey).

Sweet had eighteen successes out of 20 treated. De Schweinitz had in 6 cases 4 recoveries and two were possibly aggravated.

*Lupus.* Newcomer (Pha.) has treated successfully 30 cases few of which have shown any disposition to recur.

*Carcinoma.* In four extensive cases two were cured, one probably cured. The fourth did not continue treatment. (Bulson).

A case in which the orbit was exenterated and parts of the adjacent bones removed, was treated several times weekly for two years, with complete recovery. (Würdemann).

In two extensive cases involving the orbit one was cured by 27 exposures and the other by 34. (Bull).

*Congenital Nevi.* In one case there is rapidly being effected a cure. (Ring). Stewart and Given (Pha.) have had several successes with X-ray.

*Nævus Vasculosis.* The best treatment is by electrolysis and even then it is prone to recur. (Ball).

W. A. Pusey's method by carbonic acid snow is thorough and much to be preferred. (C.).

*Xanthoma.* Electrolysis has given good results in some instances. The X-ray has recently been recommended. (Ball).

Mrs. ———, aged 37. Four years ago three yellow patches appeared on the lids, one below the right inner canthus, one below and one above the left  $\frac{1}{8} \times \frac{1}{4}$  inch in size. *Treatment*: Cocaine injection, negative galvanic needle with 3 m. a. beneath patch, gradually increased to 5 m. a. for 4 minutes with needle at right angles to first. No trace of patch after 12 days. The remaining patches disappeared under similar treatment without pain. (C.).

Mrs. ———, aged 36. Had a yellow patch above and below each inner canthus. The negative galvanic needle completely removed one patch in one sitting with 5 m. a. of current. The current was turned on rapidly (without anesthesia) and the pain was so severe the patient would not consent to have a hypodermic of cocaine used and the three remaining patches were excised under chloroform.

N. B. Turn the current on very gradually to avoid pain. (C.).

*Serous Cyst of Lid.* Patient refused excision. A cyst  $\frac{1}{2} \times \frac{1}{4}$  inch, which was attached to nasal end of the edge of lower lid for 14 years, was treated with the negative galvanic needle, 5 m. a. in cyst for 3 minutes and repeated three times. No trace of cyst or scar remained. (C.).

*Blepharitis Marginalis.* Freund and Schiff obtained cures with a few exposures to a hard tube. We use a low tube which seems indicated in all superficial conditions. (C.). Fox had uniformly excellent results, with a H. F. current and vacuum electrode in 100 cases.

A boy with lids double the usual thickness for years, and eczema of lips, nose and ears, was rapidly improved by two months' raying during an irregular attendance.

In severe cases we prefer X-ray to other treatment. (C.).

*Chalazion.* The negative needle has been used and sufficient stimulation excited to obliterate the sac.

In thickening after chalazion or sty, grasp the parts with the forceps to which apply the negative sponge, with current of 2 m. a. for 2-3 minutes. (Alleman).

*Ectropion and Entropion.* Ziegler makes, in the former, with a galvano cautery tip, a row of deep punctures, 4 m. m. apart and 4 m. m. from margin of lid, on the conjunctival side. In entropion similar punctures are made on the skin side and repeated if necessary in 2-3 weeks. One to three sittings will accomplish as much as a plastic operation. Ice pads are applied for a few days.

*Entropion.* The best treatment is electrical. Introduce a negative steel needle beneath the integument parallel to the lid border and three m. m. above the edge: use 5-8 m. a. for 6-8 minutes. The cicatric-

ial contraction raises the edge of the lid in two weeks. If not, repeat the operation. (Everts).

*Alopecia of Lids.* Miss, aged 16. The lashes fell out  $4\frac{1}{2}$  years ago and have grown and fallen out at short intervals ever since. The baldness has now been complete for a month. Previous treatment; daily massage of lids for two months and eye drops for 3 months, without improvement. *Treatment:* Sinusoidal current, tri-weekly to the lids; in four months the lashes had grown to one-half their usual length. (C.).

*Distichiasis.* The negative needle with 1 m. a. inserted to the hair bulb for 20 seconds will destroy the lash permanently. If it does not fall out without traction on the forceps, repeat the needling. (C.).

*Herpes Zoster Ophthalmicus.* A. Mathewson reports a series of successful cases, treated with either galvanic pole.

Ball recommends negative galvanism to the affected area for the relief of pain.

(Personal communication from W. Golden Mortimer, New York.) In the above disease and certain painful conditions about the orbit I employ a static current with a spark gap of about one inch, (or so the application is not felt) with a glass vacuum electrode along the affected area and to the globe, from 10-20 minutes. The application immediately relieves the pain and promotes the cure.

The vacuum electrode attached to the H. F. coil will furnish the same current. (C.).

*Nictitation and Pain in the Eyes.* Aged 8. Afflicted for a year. Recovered in eight days by positive galvanism 3 m. a. daily to the lids. (C.).

*Chronic conjunctivitis.* Kassabian had a patient who suffered for seven years and was unsuccessfully treated by two prominent oculists. Recovered with X-ray medium tube at 12 inches for 1-2 minute twice weekly for 3 months, then once weekly.

A patient who had for years a chronic hyperplastic conjunctivitis, which very much disturbed her sleep, was treated medically without avail. Positive galvanism 3 m. a. with a copper electrode to the conjunctiva (cocainized) for five minutes daily, resulted in recovery in two weeks. (Coleman).

*Pterygium tenuis.* Starky obtained excellent results with the positive needle in several cases using 2 m. a. and repeating it. The needle was thrust (as we remember) at right angles under the pterygium, near the cornea and again near the canthus for 2-3 minutes. We failed in two cases to get any improvement with repeated needlings, probably on account of faulty technique. (C.).

*Trachoma.* Mayou (London) in 1902 introduced the use of the X-ray and reported perfect results in 15 cases. He everted the lids and gave 2 minutes exposure daily, with a low tube at 9 inches for 6 days; then after a week's rest semi-weekly. He ceased treatment when the granules disappeared, as the infiltration induced by the X-ray will be weeks in subsiding.

Cassidy, Rayne, Coleman and others do not evert the lids.

The writer reported his first case to the Chicago Elec. Soc. January 3, '03, which is the earliest published case in America he can find. Stevenson, Walsh, Vassutinsky, Geyser, Horniker, Romanen, Ayres and others report uniform success.

Coleman in 12 cases had good results and would not consider other methods of treatment. He uses a  $2\frac{1}{2}$  inch spark gap 8 minutes, 5 inches from tube, without a mask, for two weeks, then tri-weekly. He has since had a failure in one case and in another case of doubtful trachoma which recovered under the 500 C. P. lamp. Jackson, Fox, Suker, de Schweinitz and Sweet think the older methods equally satisfactory or preferable.

Stevenson and Walsh treated one case with a high frequency current (to the conjunctiva?) After 23 applications, with a vulcanite electrode connected with a d'Arsonval resonator, the disease disappeared "that would have lingered two or three years with ordinary treatment."

Seven cases treated with H. F. current did not improve. (N. Bishop, London).

Myers (*Oph. Review*, London, July, '97) makes 3-4 punctures in each granule with a negative needle and  $1\frac{1}{2}$ -2 m. a. The needle should be placed in the tissue (under cocain) before the contact with the positive is made. He has made 20-30 punctures at a sitting and has treated hundreds of cases so satisfactorily that he has ceased using copper and silver.

G. Lindsay Johnson (London) applies 30-50 m. a. of galvanism with electrolytic blades in the furrows of deep parallel incisions. We would not like the necrosis of tissue such a current would produce.

Rodolfi applies a *negative* copper electrode (galvanic) to the everted lids. The results were very satisfactory.

Neiswanger (Chicago) applies the *positive* copper electrode to granular surface with 3-5 m. a. for five minutes. This pole is preferable, as it secures copper cataphoresis. We prefer the above to any drug application—but now use the X-ray.

*Vernal Conjunctivitis.* Allport (Chicago) referred a case to W. A. Pusey. The growths had been repeatedly curetted and recurred

After amputation and X-ray exposures for three months recovery resulted without relapse in two years. Pusey, Posey and Zentmeyer have had successful cases with the X-ray.

*Tuberculosis.* The palpebral conjunctiva and retrotarsal folds were strewn with miliary granulations. Thirteen X-ray exposures of 10 minutes each. Recovery. (Sidney Stevenson).

*Cornea.* In neuroparalytic keratitis due to paresis of the left trigeminus Erb observed decided benefit from galvanism to the closed lids.

In parenchymatous keratitis Arcoleo obtained good results by applications of the negative galvanic brush to the conjunctiva for 5-8 minutes.

*Corneal Ulcers.* A. also reports good results by touching the ulcer 2-3 times with the brush during each sitting.

*Keratitis Pannosa.* Chrostak had admirable results by galvanization of the sympathetic.

*Ulcers.* They rapidly heal by raying (Dennett). A case of leucoma with low vision was much improved in 5 months by the use of the X-ray. (Williams).

Relapsing ulcerative keratitis with vascular opacity of the cornea of 12 years duration had been improved by local and general treatment, but the patient was annoyed by constant relapses. Roentgenization 8 minutes daily for two weeks followed by X-ray and 50 C. P. violet light on alternate days for 5 weeks, gave more relief than anything previously. The eye became perfectly quiet with  $V=20-20$ . There was no relapse during the raying. This was the longest period during the attack. (Coleman).

[Experiments with local light therapy in serpent ulcers of the cornea. Hertel E. (*Ophthalmology*, Jan., 1908).]

Hertel used as a source a constant arc light generated between electrodes of an alloy of cadmium and zinc. Forty-seven cases were for the first two days treated with disinfection of the conjunctival sac and tear passages, atropin and warm applications, and, as soon as they progressed, with radiation for 15 minutes, three times a day. Twenty-five healed without any other interference, 13 remained uninfluenced, cauterization and incision being, also, of no avail. The functional results were better with radiation, than by previous cauterization.

Martinachi (San Francisco) in 1873 was the first to use the galvano cautery in an infected corneal ulcer.

Knapp recommends it highly for pustular, fascicular, rodent, serpent and deeper circumscribed purulent inflammation of the cornea.

*Hypopion Keratitis.* Weisflog in five cases had good results with

faradization by large sponge electrode on the closed lids, with one-half hour sittings daily for 6-8 times.

*Phlyctenular Keratitis.* A child aged 15 had occasional relapses for 5 years and constantly for the past three months, uncontrolled by the usually successful 500 C. P. lamp daily which was used, or by a peritomy which relieves most relapsing ulcers. The X-ray for 10 minutes every second day healed the ulcers and cleared the cornea of  $\frac{3}{4}$  of the opacity in ten days. Rayed occasionally for 4 months and no relapse followed in three months. (C.).

*Corneal fistula.* Cornwell cured a case with galvanic needle using 1 m. a.

*Keratitis (tubercular).* Relapsing ulcer during the past year. V 20-40. Lupus of the nose of 12 years standing had been nearly cured with the X-ray but the eye had been covered with a mask. After 12 exposures to the eye it became quiet. V 20-40. (C.).

*Parenchymatous and other forms of Keratitis.* "I have used in the above the high frequency current with a vacuum electrode to the lids with immediate improvement, after failure by the usual methods." (Personal communication from J. G. Huizinga, M. D., Grand Rapids, Mich.)

*Corneal Scar.* In one case it decreased in size and density.

*Tubercular Keratitis and Iritis.* This, under the care of several men had not been influenced. X-ray treatment was followed in two months by recovery.

A corneal scar of 8 years standing nearly disappeared by X-ray treatment.

In asthenopia I have had fine results from vibratory massage followed by H. F. current."

*Pannus.* Ziegler by burning a small groove at the sclero-cornea, with a galvano cautery, has often made a peritomy with successful results.

*Opacity of the Cornea.* The strongest current (negative) used is 4 m. a. for 3 minutes directly to the cornea, but I do not think any better results are obtained than by a small current frequently applied. (Alleman)

We have seen 2 m. a. followed by severe reaction and 4 m. a. will often abrade the cornea. If dionin, or subconjunctival injections of sodium saccharate, (Fox) does not succeed we apply a negative metal electrode to the cornea with 1 m. a. for one minute daily and no reaction or pain follows, or we use the X-ray. (C.).

A musician with rheumatic arthritis and iritis and with the cornea almost totally cloudy, was practically blind. Six weeks of local and



general treatment and massage to the eyes produced no change in vision and the patient could not see to walk alone. After negative galvanism to the eyes and positive to the nape of the neck for 10 minutes every second day for 8 months the cornea completely cleared and he resumed his occupation.

Submucous hyperplasia from infection of a trachomatous patient with the lids half closed improved gradually and the palp. fissure became normal by negative galvanism to the lids and massage. (Personal communication from D. B. D. Beaver, Reading, Pa.)

*Keratoconus.* Knapp, A. Critchett, Tweedy and Panas, agree that no other treatment has given them such satisfactory results as the galvano cautery. Knapp and Tweedy consider the preforation of the cornea essential to success. We saw one successful case without perforation by Swan (Chicago) and would not be disposed to take the risk of a perforation.

Ball writes, moderate cauterization is followed by prompt healing and limited scars, while extensive burning causes iritis, suppuration and sloughing of the cornea. Perforation of the cornea should be avoided, but is not necessarily followed by bad symptoms. At least one-half of the pupillary area should be spared. Knapp burns superficially with a red heat an area from the centre down and out 4 m. m. in diameter and after a few moments a smaller zone, and lastly the cold electrode is placed in the center of the area and withdrawn immediately when it becomes red.

*Iritis with hypopion.* Mild cases are cured in a day, more severe ones in 4-7 by a fine sponge galvanic electrode applied to the lids, in 20 cases treated. (Erh).

*Acute Iritis.* A severe case recovered rapidly after hourly faradizations for three days. (Weisflog.)

*Iritis.* With 1-1½ m. a. of negative to lids I have seen the most happy results in the breaking up of adhesions, and in the improvement of vision (Alleman)

*Hemorrhage from the Iris.* Alleman reports most satisfactory results from 1½-2 m. a. of negative galvanism to the lids, with treatments for 5 minutes.

*Sequelæ of Specific Relapsing Iritis.*

R. E. improved from seeing fingers at 10 inches to 20-200, L from seeing light to 20-70.

Aged 42. During the past 18 months he has been treated with Hg. and has taken K. I. up to the present. Vision has remained as at present for the past 3 months. Fleecy opacities in each vitreous. Strabismus L. eye. Positive galvanism to lids 10 minutes daily for 2



month, R. 15-200 L. 15-120. Vibratory pneumatic massage to eyes daily for 5 minutes. After 12 days V. remained the same. H. F. with vacuum electrode to eye ten minutes daily for 11 days, V. the same. Galvanism and dionin 5 per cent. daily for 6 months. R. 20-200, L. 20-70. It is noticeable that neither massage alone or H. F. current increased the vision. (C.).

Aged 55. Sequelæ of iritis. R. E. has vitreous opacities and capsular opacity. L. similar and V. failed many years. R. E. improved from seeing fingers at 8 feet to 6-50, L. from fingers at 8 to 10 feet with 12 galvanic treatments. (C.).

*Lens. Cataract.* It is stated by Graefe (*Deutsche Klinik*, 1852 p. 445, quoted by Althaus) that applications of the negative pole of a galvanic current to the eye have been successful.

The attempt to dissolve a cataract by galvano puncture has been made by Crussel (Russia) with the result of inflammation and destruction of the eye-ball (B. and R.).

Crussel (Russia) claimed to have obtained perfect success in cases of cataract by introducing the negative galvanic needle into the lens; positive on the tongue. Thus the lens was subjected to mechanical and aqueous disintegration and to the chemical influence of the negative pole (Evetzky, *N. Y. Med. Jour.*, July, '08). We have not seen the amount of current mentioned or the nature of the cataract, but consider 1-2 m. a. perfectly safe and probably hard cataract only would furnish satisfactory evidence of the influence of the current. (C.).

Neftel reported two cases of undoubted beginning cataract in which all the symptoms of cataract were relieved and the vision completely restored by negative galvanism to the lids 10-15 minutes daily at first, then less frequently.

A. J. Erwin (p. c.) applies iodine by means of the galvanic current for the cure of incipient cataract. He applies it over the eyelids for five minutes once a day for at least a month using two to five dry cells. (The I. is doubtless applied on the negative sponge. C.)

We have seen a report by a physician (Toronto, Canada), of two cases treated by a 500 C. P. lamp. Vision improved from 20-30 and 20-40 to 20-20 and all opacity disappeared. (C.).

*The Galvanic Current in the Treatment of Certain forms of Cataract.* (J. Elliott Colburn. *Jour. A. M. A.*, June 4, '87.) This subject is still in its infancy, but its importance justifies further careful experiments, mainly with reference to beginning cataract. I have arranged my cases in the following groups: *Group 1* includes those cases in which there was no improvement.

Case 1, Mrs. ———, aged 49. R. V. 15-80. L. V. 15-100.

Peripheral cataract both eyes, long, narrow spikes extending to center of lenses; no nebulae; no change in vision for 2 years. 15 treatments in one month. Later glaucoma developed in R. E.

Case 2, Mrs. ———, aged 52, R. V. 20 L. V. 2-60. Peripheral cataract. Many long spikes; no nebulae; occasional sittings for 2½ months.

Case 3, Mr. ———, aged 54, R 20-80, L. 20-40. Peripheral cataract; long and short spikes; calcareous deposits at periphery of lenses and much nebular matter.

*Group 2* includes cases that have been under observation from 4-7 years, in which the improvement has been permanent.

Case 1, 1879, Mrs. ———, aged 50, R. V. 15-100, L. 15-60. Peripheral cataract; dense nebulae about lines; losing vision slowly; 4 months under treatment. R. V. 20-30, L. 20-20. Six and one-half years later there was no perceptible loss of vision.

Case 2, 1880, Mrs. ———, aged 52, R. E. 15-40, L. 15-60. Peripheral cataract; long and short lines with dense nebulae; cannot read with rapidly for 2 months; treated 2 months, R. 15-30, L. 15-15. Four years later reported no loss of vision.

Case 3, 1880. Mrs., aged 57, R. V. 20-100, L. 20-100. Peripheral cataract. Long lines and dense nebulae; first noticed loss of vision 2 months ago; forty sittings in 4 months, R. 20-80, L. 20-60, and reading vision improved from Snellen No. 10 to No. 3; 18 months later vision improved.

Case 4, 1881, Mr. ———, aged 63, R. V. 15-100, L. 15-200, peripheral cataract; long and short lines with dense nebulae; cannot read with glasses; no change in vision for 6 months previous; treated two months, R. 15-40, L. 15-100; can read with glasses. Two years later no perceptible change in vision.

Case 5, 1883, Mrs. ———, aged 70, R. 15-100, L. reading No. 5 Snellen; long and short lines, more or less dense nebulae; losing vision 6 months; treated 4 months, R. 15-30, L. 15-20; with glasses reads Snellen No. 1; can thread a fine needle and do fine sewing.

Case 6, 1883, Mr. ———, aged 54, R. 20-80, L. 20-100; could not read with glasses; peripheral cataract diagnosed 6 months previous; under treatment 3 months; thirty sittings; R. 20-20- L. 20-100; four years later R. 20-90, L. 20-100.

*Group 3* includes cases in which there has been complete removal of short lines and nebulae.

Case 1, 1881, Mr. ———, aged 49; R. 20-40, L. 25-30; peripheral cataract R. E. long spikes reaching nearly to center of lens and

dense nebulae; L. are long and many short spokes; slight nebulae; 23 sittings in 2½ months; R. and L. 20-20 and Sn. No. 1. No change 2½ years later.

Case 2, Mr. ———; aged 54, R. 15-40, L. 15-15; short lines and nebulae. Daily treatment for 3 weeks and occasionally for 2 months. V. normal in both eyes; no sign of degeneration of the lens 2½ years later.

Case 3, 1883, Mrs. ———, aged 63; R. 20-20, Sn. No. 2; after daily treatment for 3 weeks could see no lines nor nebulae in left eye; in the right eye nebulae had cleared, leaving lines unchanged; four years later no appreciable change in either eye.

*Group 4.* Recent cases in which there has been complete absorption of opacities.

Case 1, 1886, Mrs. ———, aged 63; R. and L. V. 20-20; reading Sn. No. 8; peripheral cataract both eyes; three months previously doctor diagnosed cataract; treated one month, ten sittings; R. and L. V. 20-20; no lines or nebulae visible; reads Sn. No. 1. Nine months after V. 20-20 and no signs of opacities.

Case 2, July, 1886, Mrs. ———, aged 68; myopic; R. 20-100, L. 20-200; slight radii in both lenses; twenty-four treatments in one month; only one or two lines visible at the end of treatment; Nov., '86, fully recovered; can see no lines nor nebulae.

I have steadily avoided encouragement as to the result and had it fully understood that the remedy was on trial. It was soon manifest that the great change was not in the already degenerated lens structure but in that portion which was in a metamorphotic state, i. e., the nebular; this nebular matter is slowly absorbed, leaving the former gray portions of the lens clear and transparent and the lines clearly marked.

I have never seen radii that were fully degenerated become absorbed. In those cases where we would expect arrested development, there was absolutely no change nor improvement of vision, except in one case and that was due alone to the improvement of the choroid and retina.

In all cases in which the disease is progressive as indicated by the fat granules and nebulae, and when the choroid and retina are not greatly degenerated and when there are no complications of cirrhosis of kidneys or liver, diabetes or organic disease of the heart or lungs, improvement may be expected.

The cases in which improvement is not to be expected are those in which vision has remained stationary for some time, and where there are structural changes in the choroid and retina.

*Treatment:* The negative electrode placed over the eye, the

positive at the nape of the neck at the angle of the jaw, or over the stomach. The cells should be turned slowly into the circuit until a slight vertigo is experienced, then gradually increase the number of cells, the sitting occupying 5-10 minutes, at first daily and gradually decreasing to once or twice a week."

With the reliable meter of to-day we may use 3-7 m. a. daily for 15 minutes. We have not succeeded in the few cases of advanced cataract subjected to a short course of treatment. The above remarkable success well deserves further trial. Soft cataract might offer a more inviting field still. (C.).

*Episcleritis.* A case was apparently hastened with positive galvanism  $\frac{1}{2}$ -1 $\frac{1}{2}$  m. a. to the globe, gradually increasing the time to three minutes' application (Allemann).

Mrs. P. Rheumatic arthritis. The episcleral nodules were not relieved by 6 weeks of aspirin and local applications. The nodules and pain completely disappeared after 20 exposures to X-ray. (C.).

Miss ———, aged 25. She has not been free from episcleral nodules on the right eye for 3 years or on the left for 2 years in spite of the care of three oculists. Is not rheumatic. Referred by her uncle, an oculist. A small nodule disappeared after 4 radiations, and a large one after six. Complete recovery in 6 weeks and no recurrence in 15 months. Treacher Collins has lately shown us these nodules are at times tubercular. (C.).

*Opacities in the Vitreous.* Girard Tenlon thinks galvanism is the most effectual and rapid remedy. Abadie and Tirson have obtained surprising results by thrusting an electrolytic needle 8 m. m. into the vitreous.

Woodsman, aged 60; large opacity in his only eye which had been getting blind for a year; had to be lead about. The blindness increased during many weeks of treatment. After a year's treatment with the X-ray with intervals of a month or two a delicate skeleton only of the opacity remained and the man returned to his work. [(p. c.) from E. L. Kniskern, M. D., Centralia, Washington.]

*The Influence of the Faradic Current in the Treatment of Vitreous Opacities.* W. S. Little, M. D., (*Trans. of Oph. Soc.*, 1882), reports remarkably favorable results, as does Mr. Gunn (London). Little gives freely at the same time K. I. and Hg. and Gunn K. I. Since the disintegration of exudates is purely an electrolytic effect which faradism cannot cause in the least, we attribute the good results to the medication. At least the case is not proven when the treatment is a mixed one. (C.).

*Vitreous Opacities.* Aged 64. The right eye lately failed in vis-

ion and the left for the past four years. He was put under galvanism daily for a month. Vision improved in the right from 6-12 to 6-6 and in the left from 6-50 to 6-15. (C.).

A case treated for two years with iodides had vision of 25-200. In 6 weeks under positive galvanism it improved to 20-40. (Ziegler). The negative pole is indicated, but various operators have used the positive with such good results that the direction of the current in such cases is probably immaterial. (C.).

The L. E. improved from 20-70 to 20-40. Aged 54. Vision failing for a year and he had a constant epiphora. Galvanism for two months was followed by above vision, and complete relief of the epiphora. (C.).

Seventeen eyes were treated with galvanism. Five had only light perception; one improved to fingers at 6 inches. In 12 V=form. Ninety per cent. were improved 2, 40 per cent.; 4, 20-100 per cent.; 6, 200-700 per cent. (C.).

Intraocular hemorrhage in right eye, with *only light perception*; unimproved by three months previous treatment. Recovery with *normal vision*.

Doctor, aged 39. Lost consciousness and sight of both eyes three months previously. Three oculists agreed in a diagnosis of hemorrhage in each vitreous. Leucocythemia and acute toxemia had been diagnosed. Under medication the left eye recovered, while the right has had only light perception. Three consultants agreed that the right eye was hopelessly lost. With dilated pupil the mirror gave no fundus reflex. He was advised to try galvanism and referred to his oculist who returned him for treatment. Negative galvanism 3, increased to 10 m. a. to lids 15 minutes daily. Fingers could be counted after eight days in the whole field. In two weeks we had 20-67 of vision and in 18 days more 20-40. He then had annoying diplopia with diverging strabismus but was assured that it would disappear if vision should become normal. Nine months later vision was *normal* 20-20 and 0.5 (S) at 12 inches. There was no diplopia. Binocular fixation in reading. Conv.=10 m. a. No recurrence in 3¼ years. (C.).

*Chorio-Retinitis.* In several chronic cases vision distinctly improved with X-rays. In one case a patient who could not read, was enabled to read coarse print. (Kassabian).

*Diabetic Retinitis.* By the application of 2 m. a. of negative galvanism to the lids, 2-3 times weekly, Alleman succeeded in securing the absorption of old hemorrhages and in preventing new ones.

*Macular Hemorrhage.* A case under drug treatment for 3 months

remained with vision of 20-200. In one month under positive galvanism vision rose to 20-30. (Zeigler).

*Hemorrhagic Retinitis.* A case which was under general treatment for a year without effect was then put on galvanism (1-1½ m. a) to the eyes for 5 minutes daily and the general treatment not changed. In three weeks there was a happy result. (Erb).

*Retinitis Pigmentosa.* Aged 33. Sight failing 3 years and patient was unable to go alone on the street. R. E. 12-40, L. 12-50. Fields 20 degrees vertically and horizontally. Galvanism to eyes once in five days for 15 months. R. 12-30, L. 12-40. Fields 70 degrees horizontally and vertically and the patient could go alone on the street after dark safely. (Myles Standish, *Am. J. of Oph.*, Aug., '87).

1. Aged 42; losing sight for 8 years. Ret. pigmentosa and atrophy of vessels. R.=fingers 3 feet, L. 20-70. Electricity and K. I. Six months later R. 20-70, L. 20-40.

2. Aged 33; sight never good. Choroidal atrophy and diminished retinal vessels each eye. R. and L.=J. 4 barely. Galvanism 3 minutes daily for six weeks R.=1 J. readily, L. barely.

3. Aged 20; double retinitis for 3 years. Galvanism to lids and supraorbits. R. increased from 20-70 to 20-40; L. 20-40 to 20-30 and fields from 10 degrees to 25 degrees horizontally and vertically.

4. Aged 22; night blindness since 3 years of age; color blindness; vessels small; discs pale. 20-40 and field 15 degrees each eye. Repeatedly treated by medication without benefit. Galvanism 10 minutes daily for a month. The fields slightly improved. Central vision unchanged. A month later the patient wrote, "My sight is slowly getting better." (Gunn: *London Oph. H. Reports*, June, '87).

Dor cites 3 cases in which there was considerable improvement in central vision under galvanism.

Derby (Boston) has reported improvement in some cases under galvanization.

In one case Little had observed decided improvement in vision (under the use of faradism) which continued unchanged for 2 years.

L. Webster Fox has treated a number of cases with electricity successfully and says if there is no increase of the field after 3 treatments, no improvement is to be expected.

Mrs. ———, aged 34; with night blindness and 15-20 of vision in each eye, small fields and retinal pigmentation; reported ten months later that the galvanism prescribed had improved her eyes. (C.).

Mrs. ———, aged 28; teacher. Vision failing for 6 months, especially at dusk; R. and L. V. 20-40; fields at 1 foot 6 inches in diameter.



Retinæ greyish at nasal side of discs. No pigmentation, retinitis pigmentosa without pigment. After 21 daily treatments for 3 minutes of galvanism to the eyes vision rose to *normal in each eye*. Six weeks later she wrote, "My eyes are a great deal better in the darkness than before the treatment. There is now no aching in my eyes when I read. If I look at any object I cannot see around it any distance." (C.).

Sinusoidal current. Right improved from 20-80 to 20-40, L. 20-80 not improved. Doctor; aged 48; night blindness since childhood and vision steadily failing. Bars and plaques of pigment along the peripheral vessels. The sinusoidal current to the eyes daily for four weeks, gave vision as above and relieved the pain in the eyes.

*Detachment of the Retina.* Terson reports a temporary improvement in most cases and a permanent cure in recent cases by perforating the sclera with the positive needle and using 5 m. a. for one minute, which at first coagulates the liquid.

In one case puncture with positive galvanic needle 1 m. a. for one minute produced temporary improvement. (C.).

*Detachment of the Retina.* Stillson, Indianapolis, *Am. Jour. of Oph.*, 1898).

Four cases out of five treated successfully with the galvano cautery puncture. The reaction is never violent and there is no less irritable procedure possible.

One puncture is made under the most prominent part of the detachment and the second near the margin. The cautery is held for a moment until it burns a round hole. The rent remained open for 6-10 weeks. The after treatment consisted of rest in bed, with the eye bandaged and the usual medical treatment.

1. Aged 40; almost complete detachment 3 years previously and blindness. One puncture was made at the external canthus and one at the internal. Recovery in 4 weeks with 20-80 of vision, without a relapse in 3 years.

2. A nearly blind left eye for 10 months, with a detachment of lower half. Four weeks' medication gave little improvement. Two lower punctures. In five weeks the retina returned to place and remained after two years with vision of 20-100.

3. Aged 46. Vision failed 6 months, with detachment of outer lower quadrant and inability to count fingers at 1 m. A puncture was made above the ext. rect. and another below and a third at the end of 3 weeks. The retina all went back and 20-90 of vision has continued for a year.

4. Two years ago a blow on the head was followed by retinal



hemorrhage and detachment. A negative result followed two punctures.

5. Aged 36. Sudden blindness and detachment of the lower half followed exhaustive vigils. After two punctures, one remained open 5 weeks and the retina returned to place. Five weeks later there was 20-70 of vision which was the same at the end of a year.

*Retinal Thrombosis.* Aged 57. Vision of right eye failed suddenly 2 months previously and he could see fingers only at 14 inches in a limited field. The infero-temporal area of the retina was opaque gray and the macula cherry red. Negative galv. (5 m. a.) was applied to the lids for 15 minutes daily. The vision improved daily and on the 12th day was 6-15 and he could count the second hand numerals (1 m. m. long) of a watch and the field became normal. (C.).

*Glioma.* Hilgartner cites a case of double glioma in a child of 3½ years. The growth largely filled the right vitreous and was incipient in the left. Eighty-four X-ray exposures shrank the right to 2-3 of normal and completely absorbed the left.

A glioma of orbit, max. sinus and nose was exenterated 3 times; X-rays were finally used for one year with hindrance of development and absolute prevention of pain. (Würdemann).

*Optic Nerve Atrophy.* A patient under Radcliffe steadily improved, with galv., from light perception to 20-70.

A case, with 20-200 of V., was stimulated with negative galv. up to 20-40 which he retained for years after. (Ziegler).

A case arising from the fumes of wood alcohol recovered practically normal fields and vision after a year's treatment with galv. (Ziegler).

A patient variously treated unsuccessfully had R. V. fingers at 4 feet, L. 3 feet increased to Sn. No. 8 by 14 months of galvanism. (Driver).

A patient aged 45 had R. V. 25-50 increased to 20-20 in 3 weeks with galvanism. Relapse in 6 months with V. 20-30, increased to 20-20 with galvanism in 12 days. (Driver).

Dor concludes that 40 to 50 per cent. of these cases may be notably improved.

The satisfactory results reported from treatment with the X-ray have not been confirmed. (Guilleminot).

Driver employs only the constant current, as the faradic has never yielded any good results.

Gunn in 18 cases had good results in 6, doubtful in 4 and no improvement in 8 with galvanism.

Erb says the results are a little more favorable in cases with no

assignable cause. He observed that the visual results are much better than the ophthalmoscopic appearances would indicate.

Würdemann (*Ophthalmology*, Jan., 1908) furnishes an invaluable report of 17 cases, under the caption, "*Treatment of Partial Optic and Retinal Atrophy by Electricity and Massage.*" He uses in combination the rapidly interrupted faradic current, with the galvanic of the Victor wall plate and mechanical massage with the Pyncheon ear pump attachment of the Victor transformer. He has observed that the disc is reddened and vision and field are improved immediately after treatment. Also that the "reddening" is more pronounced after massage than after electricity. Current 5-10 m. a. 3-5 minutes daily or every other day for one to two years.

We assent that "One cannot expect any effect upon the visual tracts or centers from an oscillation of the eye-balls which cannot extend further than the apex of the orbit." We cannot agree with "The same may be said of the local effects of electricity, for these are peripheral treatments." We believe that electrical vibrations, especially sinusoidal, produce not only vascular stimulation, as does mechanical massage of the disc, but also do stimulate the visual tracts and centers.

The vertigo and light flashes and even cerebral hemorrhage produced by galvanism are evidences of brain stimulation, which cannot be produced by mechanical vibration. (C.).

"Thus we cannot expect any therapeutic result in descending atrophy from spinal sclerosis." (W.).

Erb says (*Hand-book*, 1883) "There are a few cases of optic atrophy in locomotor ataxia, in which a considerable improvement may be effected."

Descending optic neuritis followed by atrophy and dorsal myelitis and complete paraplegia. R. V. 6-60, L. 60-100; color-blind. Galvanism for four months with R. V. 6-18-12, L. 6-18-12. (Erb).

We exclude cases 5, 6, 8, 9, 11 and 17 (Würdemann) as the combined use of drugs masks the electrical effect and to many make it doubtful.

1. Primary atrophy; aged 10; hydrocephalus, R. 6-60 increased to 6-12; L. 6-36 to 6-18 by electricity and massage alone at intervals for 23 months.

2. Post-papillitic atrophy; aged 19; congenital lues. Total blindness; electricity and massage 18 months. R. V. 1-60, L. 0.5-60.

3. Secondary atrophy of nerve and retina from albuminuric retinitis of pregnancy. Nov. 11, '05, aged 29. She had I., strychnia electricity and horse serum in Germany and Russia and gradually lost vision. O. D. movement of objects; O. S. 6-12. Electricity, massage, iodids and strychnia at intervals till May, '97, when R. V. 1-70, L. 6-12.

7. Post papillitic syphilitic atrophy; aged 47. Mar. 11, '07. Has had full treatment for 2 years and has grown rapidly worse in the past 6 months. Electricity and massage and regular treatments; Dec. 2, '07, Right improved from seeing fingers at 1 m., to 2-60, and L. from 3-60 to 5-60.

10. Atrophy following thrombo-phlebitis. Dec. 19, '06. Massage and electricity only. Mar. 23, '07, R. V. increased from 7-8 to 6-6, L. 6-36 to 6-24.

12. Retinitis pigmentosa; aged 22. Oct. 28, '06, R. V. 6-24, L. 6-18. Sept. 25, '07, R. 6-24, L. 6-17.

13. Nyctamblyopia; retinitis pigmentosa. July 22, '07, L. V. 6-8. Electricity and massage. Aug. 10, '07, L. V. 6-6 and fields enlarged.

14 and 15. Cases from central lesions and

16. Tabetic did not improve.

Case 3 offers such a rare and crucial opportunity to compare the result of treating optic atrophy with galvanism, faradism and pneumatic massage combined, and treating it with the sinusoidal current only, that we may be excused for relating the further history. The patient was brought for consultation, and we suggested the trial of the sinusoidal current. The previous record shows R. V. 6-12 at the beginning and close of treatment and L. V. improved from movement of objects to 1-70. Under the sinusoidal current R. V. rose in two months from 6-12 to 6-8, and L. V. from 1-70 to 1-30, and a month later R. V. rose to 6-7½. Truly one swallow does not make spring, but he is a harbinger. (C.).

*Optic Atrophy.* We reported in 1906 the result of treating 23 eyes with electricity alone. Of these five had only light perception. One improved and one acquired 20-67 of vision. In 18 in which there was perception of form 64 per cent. were improved; four 60 to 125 per cent.; two 30 per cent.; three 500 per cent.; one 1,500 per cent. and two who could only count fingers acquired reading vision. There was no improvement in six. We will cite only seven of the more phenomenal cases.

1. Optic atrophy following sunstroke; aged 10, May, '83. L. eye reads J. 16 on temporal side. Strychnia one month. V. 14 J. Then after galvanism one month to the eye vision rose to J. 1.

2. Double optic atrophy, probably of cerebral origin. R. E. improved from light perception to 20-50, L. from 20-130 to 20-20. Oct., '93; aged 12; had severe headache and vomited about twice weekly and was very delicate from the age of 5-10. Fields contracted. Sinusoidal current daily; April, '04, R. V. 20-70, L. 20-20; treatment discontinued; Feb., '06, R. V. 20-50, L. 20-20.

3. Double primary atrophy. Vision improved from uncertain counting of fingers at 6 inches with each eye to ability to read her correspondence. Sept. 3, '01, Miss —, aged 36. Had been treated for a year in an eye hospital, six years previously. Vision did not improve and is at present the same. Color-blind. Galvanism to eyes daily Sept. 12th R. or L. fingers 12 inches and read the head lines of a paper for the first time in six years; Sept. 30th sinusoidal daily. Feb. 10, '02, for some time she has been able to read her correspondence. At this date her newly-found faith transferred her to the care of the miscalled Christian Scientists.

4. Double traumatic optic atrophy. Vision improved in each eye from ability to count fingers at 12 inches to 6-18. Aged 61; had been struck on the forehead and vision failed. Had been treated at the Ill. E. and E. Infirmary for three months and at a South Side dispensary, and discharged as incurable. After four months' galvanic treatment his vision was 6-18 and he returned to his work, measuring lumber.

5. Optic atrophy. Aged 70. L. eye V. 20-200 increased to 20-67 after four months daily 15 minutes treatment with the alternating current.

Amblyopia (hysterical?) R. and L. V. improved from 20-80 to 20-25. Boy aged 10; referred by oculist. Sent from school two years previously on account of failing sight. Had been treated a year without improvement. A diagnosis of retinitis pigmentosa without pigment had been made. The boy was exceedingly nervous, but had not complained of night blindness and the retinal vessels were normal. The small field of vision 20 degrees without optic atrophy and a frequent diplopia suggested hysteria.

*Treatment.* Sinusoidal C tri-weekly. The boy was treated 11 months without improvement when we thought of discontinuing. Four months later R. and L. V. was 20-25. Never despair. (C.).

Amblyopia (hysterical?). R. increased from 20-200 to 20-25, L. from 20-100 to 20-25.

Mrs. —, aged 44, never had good eyes. Sight failing nine years. Has had a dozen voluntary abortions. Fundi normal. Reversal of the blue and red color fields. Subject to temporary hemianopsias.

*Treatment:* Sinusoidal C. to eyes and general electrization, with the auto-condensation couch ten minutes daily. In two weeks R. V. 20-100, L. 20-30. Treated for a year with above results. (C.).

*Amblyopia exanopsia.* Aged 37. R. has diverged since childhood and could see the tips of the fingers at 6 inches. After six months

of the sinusoidal current at times he could distinguish the individual fingers at 2 feet and was much pleased as he could see objects in the street approach from the right. (C.).

*The Amblyopia of High Refractive Error.* We too commonly leave this condition untreated after prescribing glasses. The following case will illustrate the possibilities under electrical treatment.

P. A., aged 8, had glasses prescribed Sept. 5, '05:

R. E. +2.75 +200c, 90°: V=5-20.

L. E. +200 +200c, 90°: V=20-50.

These were worn till May 5, '08, when R. V.=20-100 L. V. 20-50. An alternating current of 10 volts was then applied to the lids and back of the neck for 15 minutes every second day. May 29th, R. E.=20-67, L. E.=20-40 Rep. July 28th V. R. or L. 15-20.

Amblyopia: Treated with galvanism or sinusoidal current 10 eyes, 4 improved 20 to 100 per cent. Six, 200 to 700 per cent. (C.).

*Asthenopia.* Aged 21; teacher. Her eyes have been weak and painful since childhood. Had photopsies, insomnia and dyspepsia. She had been unable to read with glasses prescribed by an oculist who referred her for treatment. After three weeks of galvanism daily to the eyes she could read any length of time; had no photopsies and ate and slept well.

*Asthenopia and frontal headache.* Patient was unable to read ten minutes. Is neuresthenic; not relieved by glasses. After daily 15 minutes' treatment for a month with the auto-condensation couch without an electrode to the eyes, she was free from headache and could read two hours comfortably. (C.).

*Asthenopia.* Miss G., aged 15. Reading an hour in the day or a few minutes in the evening was followed by pain in the eyes and head. Moderate comp. h. As: Ex. 2°, 20', 8° in accom. Ad. 9° Ab. 4°, 20'; converg. 10 m. a.; Stim. ad. 20'=30°. No insufficiency of obliques. Bilateral contraction of fields. Neurotic. Months of prism ad. exercise (Gould) prisms of rest, tonics, travel and long vacations afforded no relief to the head or eyes, although her health improved. Positive galvanism (4-5 m. a.) was applied to the eyes for 15 months. She rarely had a headache while under treatment and could read any length of time comfortably during the last month and up to her present age, 25, she has had at times only moderate discomfort. (C.).

*Glaucoma.* Allard places the *anode* along the whole length of the cervical sympathetic and the cathode on the back of the neck of the opposite side with 15-20 m. a. of current. In all the cases treated the pain rapidly diminished and in two cases normal vision returned.

The positive pole is used in all inflammatory processes of the eye,

(*glaucoma excepted*) (Ziegler). Thus, theoretically and substantially as borne out in practice the *anode* is useful in glaucoma as it relieves pain, reduces tension and assists absorption. (Würdemann).

A southern oculist reported three cases of acute and subacute G. They refused operation and were treated by galvanism. The *positive pole* was first tried and aggravated the symptoms. The *negative* was then applied to the lids and complete recovery followed in all three. Thus clinical experience corroborates the physiological action of the positive pole which hardens the tissues and thus diminishes excretion which increases the tension and the inflammation, while the negative softens tissue and promotes excretion. (C.).

#### **Magnet Operations for Foreign Bodies in the Eye.**

Wm. Fisher says "I believe that the giant magnet is quite as convenient for removing the metal from the anterior chamber as the small magnet. An X-ray picture only causes delay and thus favors infection. Use the magnet with a negative result in a recent injury, and even if later the foreign body is located with an X-ray picture, what more can be done? A negative X-ray picture after an unsuccessful magnet operation gives us double assurance that a foreign body is not present.

*Method of Operating.* When a foreign body is suspected and the lens has become opaque, we apply the tip of the magnet to the center of the cocainized cornea, increase the current slowly to full force, unless the body appears with a less amount. If it does not appear, turn the current off and place the tip at the edge of the cornea, and turn on the current. If the iris bulges, change the position of the magnet, to make the metal pass through the pupil. Apply the magnet to an incision in the cornea until the metal adheres to the magnet and the operation is finished. If the body does not appear on the second application, turn on the full current and make and break it several times to dislodge the body. If the metal has entered the eye back of the lens, some operators prefer an opening in the sclera and removal at that point. I am of the opinion that all foreign bodies should be extracted through the anterior chamber, although a foreign body that has passed through the sclera back of the lens, suggests removal through the enlarged original wound. The speculum and "forceps and scleral retractors must be non-magnetic."

Kipp (Newark) relates a case (as we remember) in which the magnet entangled the metal in the iris and by reversing the polarity, the metal was repelled and dislodged. This is probably an error. While it is true that a long piece of magnetized metal may be repelled by changing the polarity of the magnet, a shapeless metal particle, when



magnetized, has no definite polarity and is equally well-attracted by either pole of the magnet, as rapidly as it can be reversed, which can be easily demonstrated with a small permanent magnet. (C.).

If there is no pain, indicating the impact of the f. b. against the ocular wall reverse (interrupt?) the current now and then and move the eye in different directions, for in 10 minutes the f. b. has followed the attraction of the magnet. If the f. b. has entered the sclero-corneal border, apply the tip directly to the wound. The body will, in many cases be drawn by the magnet on the cornea to the posterior surface of the lens, perforate Zinn's zonula, where it will be known by a bulge. Then try to draw it through the dilated pupil by holding the magnet obliquely. If the f. b. enters the iris, we would have to extract the f. b. together with the iris, or after an iridectomy. Authors (including Haab (C)) seem to prefer drawing the f. b. from the vitreous into the anterior chamber. We prefer to remove it through a scleral opening. (Knapp).

In experiments with pig's eyes, we have found iron particles could be drawn readily across the diameter of the vitreous when they could not be drawn from the vitreous into the anterior chamber. (C.).

Sweet favors the taking of a skiagraph before the use of the magnet.

#### Results of Operations With the Large Magnet.

##### *Haab—165 Eyes.*

Failures .....	23
Splinters extracted .....	141
Enucleations .....	39
Sightless balls preserved ...	19
Eyes requiring cataract operation .....	71
Useful V. in these .....	51

##### *Fisher—150 Eyes.*

Symptoms of metal in eye but negative with magnet.	49
Metal removed .....	97
Metal found in ball after enucleation (magnet negative) .....	4
Good vision .....	96
Sightless .....	34
Enucleations .....	20

In one case in which we applied the magnet to the scleral wound and failed, one end of the small tip of a permanent magnet (devised by Gruening at least thirty years ago) placed in contact with the giant magnet and the other just through the sclera, succeeded at once. We then had a socket made in a tip of the giant magnet and small moveable tips with ball ends to fit into it. This was before a German devised similar tips.

*Exophthalmic Goitre.* Pfahler has on record 31 cases (of which 4 were exophthalmic) which have been Roentgenized. Twenty-eight were improved, whether permanently is not stated.

Most agree that galvanism is the proper current to be used. Newman has cured three cases in females.



1. Aged 40; neurasthenic; P. 120-150 T. 100°. Neck 13 1-16 inches. Relatives alarmed in regard to her life. Negative sponge 2-10 m. a. for 10 minutes to thyroid. General galvanization to head and solar plexus. In four months the neck was normal 12 $\frac{3}{8}$  inches; eyes not protuberant; P. 76 T. 98.5°. No nervous symptoms. Considered herself well.

2. Less severe case. Nearly well in 9 months under similar treatment.

3. Young lady was treated medically for years and grew worse. Mother had Basedow's disease. Recovered in 4 months by the use of electricity 5 times weekly.

*Electricity in the Treatment of Exophthalmic Goitre.* Robert Newman.

Miss ———, aged 17. Nov. 11, '07; the neck began to enlarge 18 months ago and increased for six months; had exophthalmos and is neurasthenic. Under medical treatment goitre decreased from 17 inches to 14 inches. The eyes are not prominent and the general health has been much improved. The goitre has not lessened in the past 3 months. P. 100, neck 14 inches below, 12 $\frac{1}{2}$  inches above.

The H. F. current was used daily for a month, with one vacuum electrode to the neck and the hands connected with the couch. The neck not less in circumference. Negative galvanism used daily for one month 7 m. a. to neck. Neck below 13 $\frac{1}{2}$  inches; 11 $\frac{1}{2}$  inches above. Alternating current daily 3 months. Neck high 11 $\frac{1}{2}$ , low 13 inches; normal. (C.).

Many successes with the use of the X-ray have been reported.

*Muscular Paresis and Paralysis.* Cases due to cerebral lesions are unfavorable. Early peripheral cases are favorable. (B. and R.).

Benedict declares that in 7 cases out of 8 referred to him by Wecker there was immediate improvement.

Paralysis of abducens for 3 weeks cured in three weeks of galvanism.

*Muscular Paralysis.* Electricity is probably most frequently used and least indicated in this disease than in almost any other condition of the eye since there is a great tendency in peripheral and tabetic cases to disappear spontaneously and suddenly, without treatment. (C.).

*Paralytic Strabismus.* One to three m. a. of negative galvanism to lids. Others use faradism. (Ball).

We prefer the constant current interrupted, as it combines the usefulness of both currents. A muscle may respond to a galvanic current after it ceases to respond to a faradic and the latter has no effect on central lesions. (C.).

*Convergent Strabismus and Amblyopia of One Eye.* Aged 17; V. L. Sn. L. at 10 c. m. Galvanism for three weeks. V. L. increased to Sn. XV (Boncheron).

*Paralysis of Right Oculomotor.* Aged 70. Occasional diplopia. Complete ptosis for 2 months. Recovery after galvanism 28 times. (Erb).

*Lachrymal Stricture.* Electrolysis was first used by Tripier and Desmarres.

*Lachrymal Stenosis.* Stevens and Jessup report ten cases with permanent cure after a few treatments. The probe was only  $1\frac{1}{2}$  m. m. in diameter, and 2-4 m. a. current used.

*Dacryocystoblenorrhoea.* A boy who had been treated by probing for months, and from whose sac, when pressed, pus still flowed over the cheek half a dozen times daily, was completely relieved of any trace of pus, after negative galvanism with 2 m. a. was applied to the ordinary probe for five minutes daily for 2 weeks. (C.).

*Epiphora.* Aged 68. Has constantly mopped his eyes during the past month. Middle turbinates very sensitive to the probe. Completely relieved and no relapse in  $2\frac{1}{2}$  years, after six applications of a positive copper electrode 3 m. a. to the turbinates daily for three minutes. Cotton moistened with cocain and adrenalin was wound around the electrode. (C.).

*Sarcoma of the Orbit.* Morton (N. Y.) injects the tumor with quinine bichloride which becomes phosphorescent under the X-ray and is thus influenced by X-rays, violet and ultra-violet rays.

*Vascular Tumors of the Orbit.* Barry uses one or two (bipolar) needles with 10 m. a. for five minutes.

*Sarcoma.* An inoperable case involving the orbit and accessory sinuses was apparently cured by 50 exposures of five minutes daily with a high tube at 10 inches for 4 weeks, then less frequently. (Fox).

Sarcoma of the orbit of four years' duration which had been twice operated was cured by X-ray. (Beclere).

A growth of seven years standing entirely disappeared after 13 exposures. (Kienbock).

An inoperable case recovered in seven months. (Theobald).

Three cases recovered and one did not improve. (Pfahler).

Wescott (Chicago) in a case of incompletely exenterated sarcoma, rayed the patient for 3 months. Recovery. No recurrence at the end of the year.

Bull in 8 cases has not found X-rays of value either before or after operation except in the relief of pain.

*Orbital Cellulitis.* Boy aged 15. Right eye red for 8 days.

Proptosis directly forward  $\frac{1}{4}$  inch; eye nearly immobile. V. 20-200; no pain or T.; choked disc; vitreous hazy; retinal veins large and tortuous; (accessory sinuses normal. (Brawley)).

*Treatment:* Aspirin; violet light 50 C. P.  $\frac{1}{2}$  hour daily, iodo-nucleoid, exploratory incisions to apex of orbit; no pus. No improvement; X-ray 8 minutes daily and 500 C. P.  $\frac{1}{2}$  hour bd. The left eye is slightly involved. Complete recovery in 5 weeks with vision of 20-20. As light had been previously used the X-ray seems the more important factor. (C.).

*Supraorbital Neuralgia.* A boy with left supraorbital neuralgia daily for 4 months had been treated by galvanism daily for a month with very little relief and was referred for treatment. A. H. F. vacuum electrode, the rheostat being low on the solenoid of the resonator, applied twice daily to the supraorbit for 5 minutes relieved the pain completely in five treatments. No relapse after one month. (C.).

#### **Light Therapy.**

With the 500 C. P. lamp the patient reclines on a couch with a fan in hand to be moved to and fro, as the heat can be borne 12 inches from the face for 3-30 minutes, according to the acuteness of the inflammation, etc. We use the 50 C. P. with a violet screen within 4 to 6 inches of the patient. We have found the lamp useful in blepharitis marginalis, ulcer of the cornea, iritis, trachoma, purulent otitis med, and mastoiditis (non-carious) the last of which has repeatedly completely recovered.

*Retinitis Pigmentosa.* H. aged 41, machinist, consulted J. E. Harper, (Chicago) who confirmed the diagnosis of retinitis pigmentosa. Vision had been impaired for 24 years and steadily became worse up to three years ago. His vision was so low he had to be led about the streets. Referred for treatment with the 500 C. P. lamp to Dr. Rogers who reported the light was applied for 5-10 minutes daily for six weeks and then the patient was referred back to Dr. Harper, who wrote: "I find Mr. H. sees letters upon the line to be read at 20 feet when he sits at 18 feet. The patient has since been working at his trade." In an interview Dr. Harper said he might have doubted his first record of 20-200 of vision, had not an attendant of the patient confirmed it. (C.).

#### **High Frequency Current in Ophthalmic Practice.**

L. Webster Fox, *Journal of Advanced Therapeutics*, Apr., 1907, used a H. F. coil with an Oudin resonator and made the application to the lids by a Wappler vacuum spiral tube and directly to the cornea by vacuum eye electrodes, for 2-20 minutes three times

weekly to daily, and the patient was kept under treatment until assured no benefit could be derived.

*Blepharitis Marginalis*—100 cases. The cases were treated ten minutes daily for two weeks. The cure was rapid and apparently permanent in all.

*Granular Lids*—10 cases. After 20 treatments to the external surface of the lids in each case there was no apparent benefit, so this was abandoned.

*Ulcers of the Cornea*—25 cases. This covered all forms from simple to Saemisch. The application was made directly to the lids and also to the cornea. Where there was destructive tissue with pus shreds the current seemed to retard the destructive process; and in one case of Saemisch it was cured without the aid of drugs or operative procedure. The electrode was applied to the cornea under cocaine in all. The H. F. current is of some value in these cases.

*Iritis*—5 cases. Three specific, two rheumatic. There was no notable change for the better, but the pain was certainly lessened. In one case the effect of 10 minutes' treatment was magical; it gave instant relief, which lasted for three or four hours.

*Ophthalmoplegia Interna*—1 case. Ten applications were made to the sup. cerv. sympathetic. No result.

*Vitreous Opacities*—20 cases, including all forms. As many as 50 applications were given in some cases, while in the majority of cases there seemed some clarification, yet there was not as much improvement as subsequently under the constant current.

*Retinitis Pigmentosa*—3 cases. The fields and vision slightly improved.

*Amblyopia Exanopsia*—10 cases. A patient aged 52 with V. of 15-200 was improved to 20-50 after 30 applications with the vacuum electrode, used for 3-15 minutes. Fox is quite sure that we have in electricity a curative measure much more simple and radical than the fusion method with the amblyscope. The function of the amblyscope seems quite different from that of electricity. It is conceded the former develops the fusion power; the latter may increase vision. (C.).

*Retinitis Proliferans*—2 cases. Ten applications; little change.

*Retinal Hemorrhages*—10 cases. Eight improved after 2-4 weeks' treatment.

*Optic Neuritis*—1 case, and atrophy 10 cases, were not benefited.

*Glaucoma, chronic*—5 cases. No change produced in tension, etc.

Fox has rendered a most invaluable service to ophthalmology chiefly by clinical demonstrations of what the H. F. current cannot do.

The H. F. current acts as a vasomotor stimulant and produces general trophic changes, but it is not *electrolytic*, does not cause *muscular contraction*, or produce a *light flash*, hence it cannot be expected to respectively clear up vitreous opacities, improve paretic or paralyzed muscles, or restore vision in optic atrophy. Thus the physiological action of a current indicates what cannot and what may be done clinically.

So much detailed testimony of able, conscientious and critical workers should be sufficient to demonstrate the usefulness of electricity in ophthalmic practice, and that the results are not chiefly due to suggestion, coincidence or the sprites. There are none so blind as those who will not see. Prove all things. Hold fast that which is true.

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# CHAPTER X.

## SERUM AND BACTERIAL THERAPY—SERUM AND BACTERIAL REACTIONS IN DIAGNOSIS.

BY ERNEST E. IRONS, M. D., CHICAGO

*Theories of Immunity—Antitoxins, Agglutinins, Bacteriolysins, Precipitins, Opsonins—Passive Immunity and Serum Therapy—Antidiphtheric Serum—Antitetanic Serum—Antistreptococcic Serum—Antimeningitic Serum—Antigonococcic Serum—Antipneumococcic Serum—Deutschmann's Serum—Maragliano's Serum in Tuberculosis—Bacterial Therapy and Active Immunity—The Opsonic Index—Active Immunization by Vaccines—Tuberculin Immunization—Staphylococcus, Streptococcus and Gonococcus Vaccines—Serum Reactions in Diagnosis—The Wasserman Reaction in Syphilis—Bacterial Reactions—Phenomena of Hypersusceptibility—Tuberculin Reactions of Koch, v. Pirquet, Calmette, and Moro—The Ophthalmo-Typhoid Reaction of Chantemesse—Other Bacterial Reactions.*

Pathological processes of an infectious character, involving the tissues of the eye, follow the same general laws as do infections elsewhere in the body, and aside from certain special secondary features depending on the ocular structures affected, the susceptibility to infection, course of invasion, pathological changes, and mechanism of cure conform to those of infections of the viscera or other parts of the body. Moreover, the ocular manifestation is often only a part of a more or less widely spread general infection, against which remedial measures must be directed. Even in those instances in which the infective process is limited to the eye, the body often shares to some extent in the intoxication, and through the reaction of its cells and tissues, forms substances which, reaching the focus of infection by way of the circulating blood and lymph, assist in the limitation of the disease.

Our present conception of infectious processes, and the mechanism by which they are terminated, either spontaneously or by the intervention of antibacterial or antitoxic sera, etc., is based on certain principles which may be grouped under the general topic of immunity. Before entering upon the discussion of the several methods of specific therapy in disease it will be of advantage to survey briefly a number of familiar facts, illustrating these principles and theories by which we are to be guided.



**Immunity.**

Immunity in general may be defined as the condition of non-susceptibility to disease. This non-susceptibility may be natural as in the case of man who normally does not contract certain of the diseases of lower animals, such as swine plague, or of animals which cannot be infected with certain of the diseases of man, such, for instance, as scarlet fever. Natural immunity is frequently only relative, certain individuals or members of a family showing a greater resistance to infection than others. Immunity is acquired by an animal either by passing through an attack of a disease, or by the inoculation of bacteria or their products, by which process it passes into a condition of non-susceptibility to infection by the organism used for inoculation. Familiar examples of acquired immunity in man are found in the case of diseases such as small-pox and scarlet fever, in which one attack usually protects for life. In other diseases such as diphtheria, typhoid fever and pneumonia, repeated attacks are common, though even here there is evidence, both laboratory and clinical, to show that at least a temporary and sometimes a lasting immunity is produced.

Artificially an immunity may be produced by the inoculation of repeated non-fatal doses of living or dead bacteria, or of substances produced by them. In this way Pasteur in 1882 immunized sheep against anthrax by the injection of attenuated cultures of anthrax bacilli. The widely practiced immunization against bubonic plague, typhoid fever, and cholera by the injection of dead bacterial cultures are other examples of the same method by which active immunity to disease is artificially produced.

In antitoxic serum (antidiphtheric and antitetanic serum) we have another means of producing immunity. Here, however, the antibodies are introduced into the patient ready formed, and the immunity is termed *passive* as against the active immunity brought about by the injection of bacteria or their products directly into the patient.

In the case of diphtheria antitoxin, an active immunity is produced in the horse by the injection of increasing doses of toxin, and when the serum thus obtained is injected into a patient suffering from diphtheria a passive immunity is conferred.

**Theories of Immunity.**

A number of theories have been proposed to explain the mechanism of the production of immunity. Those of Metchnikoff and Ehrlich have gained the widest acceptance. Metchnikoff contended that the principal defense of the body against disease is the phagocyte which ingests the invading organism and destroys it. He regarded inflammation as essentially a process of



phagocytosis, and held that the various antibodies and ferments which are demonstrable in the serum are produced by the various phagocytic cells, to be liberated by them in the presence of infecting bacteria. Certain points of this theory we shall find of importance later in our consideration of recent work in bacterial therapy.

Ehrlich's side chain theory accounts more completely and satisfactorily than any other for the phenomena observed in immunization, although it too leaves a number of facts unexplained. Ehrlich assumes that the body cell consists of a central atom-group, with a number of side groups which have the power of combining with food stuffs, etc. These latter are called *receptors*. Some of the receptors which have a single combining group are concerned in the assimilation of the simpler food stuffs and are called *receptors* of the *first order*. Other more complex receptors have two unsatisfied combining groups, one for the food molecules and the other for a ferment. These are called receptors of the second order, or *amboceptors*. In the production of diphtheria antitoxin the theory assumes that the toxin molecule after injection unites with a receptor of the body cell. This receptor being no longer of service to the cell in the assimilation of food is cast off into the circulating blood and a new receptor is formed to take its place. This second receptor is likewise joined by a toxin molecule and the combination is cast off by the cell. Following the general biologic principle that regeneration usually goes on to over-regeneration, the receptors continue to be formed and cast off by the cell, so that not only are all the toxin molecules united to receptors but there is a large number of uncombined receptors circulating in the serum. It is these free receptors which constitute the essential portion of the antitoxin. This theory is further extended to explain the production of the immune bodies of antibacterial, hemolytic, and other immune sera. In these, however, the exciting bodies corresponding to the toxin are more complex in molecular structure, and the antibodies are derived from the receptors of the second order, the amboceptors.

In addition to antitoxins the injection of bacteria or their products into the animal body results in the formation of a number of other bodies, the nature of which is only partially understood. The well-known Gruber-Widal reaction may be taken as typical of the phenomena exhibited by *agglutinins*. If a small portion of the serum from a patient suffering from typhoid fever, or from an animal which has received injections of typhoid bacilli, is added to a suitable suspension of typhoid bacilli the organisms after a time lose their motility and collect together in clumps. This agglutination phenomena may be demonstrated in the case of many species of bacteria and with certain excep-

tions is specific for each organism, so that it has come into extensive use in diagnosis. Another class of bodies in immune sera is that of the *bacteriolysins*. If the bacteria employed in the agglutination reaction are observed closely they are seen to become granular and partially dissolve, and on transfer to favorable media are no longer capable of growth. This bacteriolytic process was first demonstrated by Pfeiffer, working with the cholera spirillum. It appears probable that a number of the antibacterial sera owe their curative properties to the bacteriolysins which they contain.

*Precipitins* constitute still another class of bodies found in immune sera. If a portion of immune serum is added to a clear bacteria-free filtrate of a culture of the immunizing organism the mixture becomes cloudy from the formation of an albuminous precipitate. This reaction does not appear when normal serum is used and has been shown to be specific for each organism. Finally one other class of bodies, the *opsonins* must be mentioned. These are present in both normal and immune serum and by their action on bacterial and certain other cells render these more susceptible to phagocytosis. They will be discussed in the section on bacterial therapy.

#### **Passive Immunity and Serum Therapy.**

Prophylactic and curative sera, bacterial vaccines, and the specific diagnostic serum and bacterial reactions, with a few exceptions, are still in the experimental stage. Certain of these no doubt will prove of great value; others will be shown to be inadequate or unreliable as have others before them. The advances of the past five years have been so rapid that the discussion of serum and bacterial therapy at the present time must necessarily be limited to a statement of the trend of scientific and clinical research, outlining those procedures which give most promise of permanency and avoiding dogmatic statements, even at the risk of leaving the reader at times uncertain as to the exact value of a test or of the potency of a remedial agent.

#### **Antidiphtheric Serum.**

By far the most successful and widely known of the specific sera is antidiphtheric serum, the general employment of which has reduced so remarkably the mortality in diphtheria. Its use in diphtheric infections of the eye has been attended with the same favorable results as in cases of the ordinary pharyngeal and nasal infections. Antidiphtheric serum has been used also, empirically, in the treatment of various suppurative lesions not due to the diphtheria bacillus, such as corneal ulcer of pneumococcal origin, purulent conjunctivitis, hypopyon, etc., with reported benefit. These reports, however, are in the main of isolated cases, and it is probable that just as

favorable results might have been obtained had other therapeutic measures been employed.

#### **Antitetanic Serum.**

Antitetanic serum, similarly to antidiphtheric serum, is obtained from horses immunized to increasing doses of the tetanus toxin. The greatest value of antitetanic serum lies in its prophylactic use in lacerated and deep puncture wounds in which experience shows that tetanus infection is likely to occur. Cases in which tetanus develops following lacerated or other wounds when the early prophylactic injection of a suitable dose of tetanus antitoxin has been made, are extremely rare. In cases which come under treatment after the symptoms of tetanus have appeared, the injection of the serum locally, intraneurally or by lumbar puncture is indicated. Many cases have undoubtedly been saved by its use, the beneficial results depending on the early neutralization of the toxin, before it has become widely diffused throughout the nervous system.

#### **Antistreptococcic Serum.**

The diphtheria and tetanus bacilli produce soluble toxins, which can be used in the immunization of animals with the resulting formation of antitoxins. In the case of certain other bacteria such as the streptococcus, staphylococcus, pneumococcus, and gonococcus, the toxins are to a large extent at least, intracellular, and much greater difficulty is experienced in obtaining their corresponding immune sera. Moreover, different strains of streptococci vary greatly in virulence among themselves for the same animal, and different species of animals may exhibit wide variations in susceptibility to infection by any one strain. Several strains of virulent streptococci are usually employed in the immunization of animals, and the antistreptococcic serum produced is thus polyvalent. Antistreptococcus serum has been used in a large number of cases of cellulitis and other streptococcus infections, and many favorable clinical results following its use are on record, including severe infections about the face and eyes. There is a constant tendency however to report favorable cases, while the large number of cases not responding to treatment pass unnoticed. Moreover, the clinical course of streptococcus infections is proverbially uncertain, and, as in pneumonia, this fact has led clinicians to attribute cures to the most diverse empirical remedies. For this reason it is advisable to exercise caution in accepting the favorable reports on the use of antistreptococcic serum, although it must be admitted that the serum has a certain claim for recognition as a scientific attempt at specific therapy.

**Antimeningitic Serum.**

Within the past year the antimeningitic serum of Flexner has been employed in the treatment of epidemic cerebrospinal meningitis. In the analysis of 400 cases (1908), Flexner<sup>1</sup> found an average death rate of 25 per cent. In cases receiving the serum on the first to the third day, the mortality was 14.9 per cent., while in cases treated first after the seventh day the mortality was 36.4 per cent. These cases occurred in widely separated epidemics, and the average mortality is decidedly lower than has been found heretofore under symptomatic treatment.

**Antigonococcic Serum.**

Torrey has recently advocated the use of the serum of sheep immunized by injections of the gonococcus in the treatment of gonococcus infections. An analysis of the data thus far obtainable indicates that in general, but little benefit follows the use of the serum in gonococcus infections of the mucous membranes including the conjunctiva. In the deeper localizations such as arthritis the results are somewhat more encouraging. Several cases of gonococcus iritis have shown improvement after the serum, and though the results are not uniformly good, they appear to justify further trial.

**Antipneumococcic Serum.**

Antipneumococcic serum has received an extensive trial in pneumococcal infections. In lobar pneumonia, and other general infections, the results have not been encouraging. Isolated cases, and in some instances small series of cases have been reported in which recovery followed the use of the serum, but the consensus of opinion is that its value in this class of cases has not been demonstrated.

Römer<sup>2</sup> has made an extensive study of antipneumococcic serum in serpiginous ulcer of the cornea. In his first series of cases in which he used a polyvalent serum, he obtained somewhat better results than in a control series in which the serum was not used.

Later he supplemented the injections of serum by active immunization using for this purpose vaccines prepared from pneumococcus cultures. The suspension of killed pneumococci was given preferably first, followed in a few hours by the serum. Using this technique Römer was able to check the advance of the ulcer and obtain healing in 20 out of 24 cases. In 2 cases he had to resort to the galvano-cautery, and in the remaining 2 cases panophthalmitis developed. Some observers have been inclined to regard Römer's last series as made up of unusually favorable cases, and claim that if the infections had been of average virulence, his results would have been no better than those following ordinary symptomatic treatment. Römer has

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1. See bibliography at end of this section.

devised a method of injecting mice with progressive dilutions of the cultures obtained from each case, and ascertaining the minimum fatal dose of each strain. In this way the virulence of each infection being known, cases of equal virulence with and without active and passive immunization can be compared more accurately than by the clinical signs alone. Römer maintains that in his series, comparing cases of equal virulence as determined by animal inoculations, more rapid and satisfactory results were obtained with than without the serum.

#### **Deutschmann's Yeast Serum.**

In 1907 Deutschmann<sup>3</sup> published the results of his researches on serum derived from animals that had been fed on yeast cells. He claimed that although the serum contained neither demonstrable antitoxic, nor bactericidal properties, it had a distinct restraining and curative influence on pus infections and even infections by the tubercle bacillus. He recommended the serum in the treatment of corneal ulceration, parenchymatous keratitis, plastic iritis, and for wounds about the eye. v. Hippel<sup>4</sup> has recently published a series of cases including plastic iritis and serpiginous ulcer in which he gives considerable credit to the serum. The action of Deutschmann's serum is not understood. It has been thought by some to act as a direct stimulant to phagocytosis. In this connection it may be noted that several of the specific sera, such as diphtheria antitoxin, tetanus antitoxin, etc., have been employed in diseases other than those for which they were intended, with reported benefit. Normal horse serum has also been used in the treatment of various pus infections. The unprejudiced observer must remain somewhat skeptical as to the value of a serum in cases of this character, where the claim for its good results is based only on empirical grounds.

Immune sera have been employed in either the prophylaxis or cure of a number of other diseases of known bacterial origin. Anti-plague and anticholera sera have been used extensively in the Orient. Recently Chantemesse<sup>5</sup> advocates the use of antityphoid serum in typhoid fever and claims that it materially mitigates the severity of the disease.

#### **Maragliano's Serum.**

Maragliano has immunized animals (horse, cow) against tuberculosis, and finds that the resulting immune serum possesses bactericidal, antitoxic, and agglutinating properties for the tubercle bacillus. His statistics as to the clinical value of the serum, while not conclusive, seem to show somewhat more favorable results in cases in which the serum was used than in those in which the treatment was hygienic only. In some of his cases, Maragliano combined passive and active immun-

ization, using for the latter gradually increasing doses of an extract of tubercle bacilli.

#### **Marmorek's Serum.**

Marmorek, by the immunization of horses with the toxins from young cultures of the tubercle bacillus has produced an antitoxic serum. The results obtained with this serum are not uniformly favorable, although in a number of instances including cases of tuberculosis of the larynx and virulent tuberculosis of the conjunctiva and cornea cures are reported following its exclusive use.

Reference must here be made also to certain preparations for the treatment of exophthalmic goitre. Beebe has injected animals with thyroid gland and obtained an anti-serum with which good results have been apparently obtained in some cases. Thus far however the serum has not accomplished all that was hoped for it. A preparation from the milk of thyroidectomized goats has also been used with benefit in some instances.

#### **Bacterial Therapy and Active Immunity.**

Early in the eighteenth century, following the observation that one attack of smallpox protected the individual against subsequent attacks, the inoculation of healthy persons with the virus from a mild case of smallpox was extensively practiced, and after the discovery by Jennes of the protective power of successful inoculation with virus from cowpox, vaccination against smallpox became world-wide. Soon after the discovery of the bacterial etiology of anthrax, Pasteur, having observed that one attack of anthrax protected sheep or cattle against subsequent infection, devised the method of protective immunization of healthy animals by the injection of attenuated cultures of anthrax bacilli. A few years later he proposed the treatment of rabies by the injection of attenuated virus contained in the dried spinal cords of infected rabbits.

Thus gradually the idea of the prophylactic production of active immunity to disease gained ground, and it was only a step further, to the application of the method to cases in which infection was already present. We have seen that the injection of bacteria into the animal body gives rise to the production in the serum of certain substances that have a definite destructive or inhibiting effect on the bacteria, and that these substances are within certain limits specific for each bacterium. Metchnikoff held that the essential factor in immunity was the phagocytic cell. Later Denys showed that if leucocytes are washed free from serum, they are no longer able to ingest bacteria. If, however, the bacteria are treated with serum, and then mixed with the



washed leucocytes, they are at once taken up. This sensitizing substance, which prepares the bacteria for phagocytosis is called opsonin.

Opsonins are present in normal serum, and following the injection of bacteria are increased as are the other known immune substances such as the agglutinins and bacteriolysins, though the increase of the several immune bodies is not necessarily in equal proportion in any given case. Thus Hektoen<sup>6</sup> showed that an immune serum may have marked opsonic and little or no bacteriolytic properties, and vice versa. In their structure opsonins are thought to resemble agglutinins and are, in the terms of Ehrlich's side chain theory, receptors of the second order.

From a study of opsonins in their relation to infectious processes, Wright<sup>7</sup> developed the idea that they play an important part in the production of immunity in infections. He showed that in cases of infection by the tubercle bacillus for example, the injection of small quantities of tuberculin, containing the bacilli and their products, was followed by certain characteristic fluctuations in the amount of opsonin, and proposed therefore to use the opsonic power of the blood as a guide to the therapeutic injection of the bacterial products.

#### **Technique of the Opsonic Index.**

The opsonic index is determined by comparing the amount of phagocytosis occurring in suspensions of leucocytes, bacteria, and normal serum with that taking place in a similarly prepared suspension to which has been added in place of the normal serum, the immune serum to be tested. The leucocytic suspension is prepared by allowing about 20 drops of blood from a puncture of the finger or ear to flow into a tube of .85 per cent. sodium chloride solution to which 1 per cent. sodium citrate has been added. Upon centrifugalization, the red corpuscles collect in the bottom of the tube, and the leucocytes in a lighter colored layer just above, the so-called leucocytic cream. After a second washing with sodium chloride solution, the supernatant clear fluid is pipetted off, and the leucocytic layer, together with a certain unavoidable number of red cells, is removed for use in the opsonic determination. The bacterial suspension is obtained by washing off with salt solution the bacterial growth from a young (preferably an 18 to 24 hour growth) culture on agar or other solid medium, of the organism in question. The suspension is centrifugalized to remove clumps of the bacteria and the density of the resulting opalescent fluid adjusted so that it contains a suitable number of organisms. This is important, for if too many or too few bacteria are present in the mixture of leucocytes and serum, errors in the estimation of phagocytosis will result. For tuberculo-



opsonic determinations the residue of bacilli after the preparation of old tuberculin is frequently used. The organisms are washed free from glycerine, etc., are ground up in a mortar, suspended in 1.5 per cent. salt solution, and the resulting suspension centrifugalized to remove the clumps. Difficulty may be met with in obtaining homogeneous suspension of certain organisms such as the gonococcus and meningococcus, but this can be avoided to a large degree by the use of young cultures (12-18 hours).

The serum for the test is collected from a needle puncture in the finger or ear of the patient, two or three drops of blood in a capillary U-tube being sufficient. After the blood has been allowed to clot, the serum is collected by centrifugalization. The normal control serum is obtained in the same way by mixing the sera from two or three normal persons.

Equal volumes of the serum, leucocytic suspension, and bacterial emulsion are mixed and incubated at 37° C. for 10 to 20 minutes. A convenient pipette for mixing is obtained by drawing out a glass tube into a fine capillary several inches in length, and then bending it at right angles. A mark is placed at a distance of an inch or so from the end, and the serum, leucocytes and bacterial emulsions are drawn up successively to the mark, allowing a small air bubble to intervene between each volume. The contents of the tube are expelled upon a glass slide and mixed by drawing gently back and forth into the pipette. The mixture is returned to the pipette, which is sealed in the flame. A similar procedure is carried out with the mixture or pool of normal sera, and the two pipettes incubated at 37° C. for 10 to 20 minutes. Smears are made from each pipette, fixed and stained. Fixation may be accomplished by heat, or by the application of ethyl or methyl alcohol, or saturated aqueous solution of corrosive sublimate. A number of staining solutions are in use. Carbolthionin, J. H. Wright's stain, or methylene blue give good results. For tests with the tubercle bacillus the ordinary carbol-fuchsin or anilin-fuchsin is used followed by methylene blue after decolorization.

The degree of *phagocytosis* is determined by counting the number of organisms taken up by a consecutive series of 50 to 100 leucocytes, and calculating the average number per leucocyte. The opsonic index is found by dividing the average number of organisms taken up per leucocyte in the mixture of serum to be tested, by the average number per leucocyte in the normal control serum mixture. Thus, if the average in the test serum mixture is 3 organisms per leucocyte, and the average in the control is 5, the opsonic index is 0.6.

In any given series of leucocytes there will be, providing the bac-

terial emulsion is of proper density and the incubation time not too long, a certain proportion of leucocytes which have not taken up organisms. Simon has suggested that the relation of the per cents of phagocytizing cells in the immune and control serum mixtures be determined just as in Wright's method, and that this quotient be called the phagocytic index. As a rule the curves obtained by plotting the opsonic and phagocytic indices show corresponding oscillations.

Wright has demonstrated that in any one of a series of normal individuals, the opsonic index for any given bacterium lies within certain limits, usually .8 and 1.2. In other words, the amount of opsonin present in normal serum is a fairly constant quantity. In the course of an infection the index curve shows marked oscillations, which may be correlated with the variations in clinical symptoms. Thus in the stage of invasion or in the case of laboratory animals following an injection of bacterial suspension, the opsonic index falls, sometimes as low as .1 or .2. This fall is denominated the "negative phase." Later during the stage of improvement, or reaction the index rises above the normal, reaching 2.0 or 3.0 or higher.

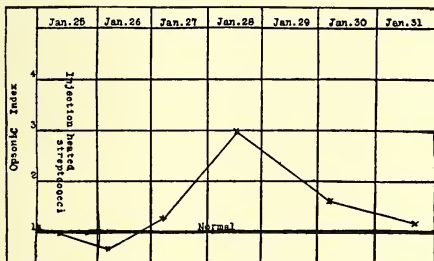


Fig. 18—Chart showing increase of streptococco-opsonic index in a healthy man in response to injection of heated streptococci.—(L. Hektoen, *Jour. Amer. Med. Assoc.*, May 12, 1906.)

Wright has proposed the opsonic curve as a means of diagnosis, and as a guide in the therapeutic administration of vaccines. In a case of suspected tuberculosis, for instance, if the tuberculo-opsonic curve is persistently low, or fluctuates beyond the normal limits, either while the patient is at rest, or after exercise or massage of affected parts, this is taken as evidence in favor of tuberculous infection. It is assumed that an opsonic index above normal indicates a reaction on the part of the body against the infecting organism, and the therapeutic immunizing injections are so spaced that this reaction may be maintained, as evidenced by the continuation of the index slightly

above normal. The giving of a second injection before the reaction from the negative phase of the previous injection has occurred, may result in a prolonged depression of the opsonic curve, and a corresponding exacerbation of symptoms. Persistent low indices are regarded as undesirable.

Opsonic estimations also serve to indicate the amount of immunizing material to be injected. If after the first injection the low index is further depressed, the dose has been too large. Or if the dose is too small to produce a reaction, no rise in the index results. Numerous cases have been reported by Wright and others, both in this country and abroad in which the opsonic determinations have apparently been of value as a guide to the size and interval of therapeutic bacterial injections.

It is held by many that the importance and reliability of the opsonic index have been much overrated. In addition to the difficulty of technique and certain unavoidable errors in the preparation of the serum mixtures and the making of the smears, there is a considerable variation in the counts in two or more consecutive series of 50 leucocytes, and to obtain approximately constant results it is frequently necessary to count 100 or more leucocytes. Even then the results obtained by different workers on the same set of slides show marked differences. In the second place, it is urged that the course of the opsonic curve does not always correspond to the clinical findings. Patients with persistently low indices sometimes improve and in patients in whom the disease is advancing, high indices may be found. Opsonins are only one of the several substances found in serum which vary with the progress of infections, and are not necessarily more important as a measure of immunity than are agglutinins or bacteriolysins, which at the time of their discovery were thought to offer methods for the gauging of the progress of immunity.

While a conservative position in regard to opsonins is advisable, there seems to be no question that the opsonic curve displays definite and characteristic fluctuations which for the most part can be correlated with the clinical changes. Indeed it frequently happens that the opsonic index shows characteristic fluctuations a number of hours before the oncoming pathological changes become manifest by clinical symptoms. There are those who hold that vaccine therapy should not be attempted unless controlled by opsonic determinations, while others maintain that clinical findings furnish sufficient evidence for guidance in therapy. Although we may reasonably doubt the value of some of the slighter fluctuations in the opsonic curve, we must admit that the more marked variations are beyond the ordinary limits of error, and

indicate to some degree the changes that are taking place in the body fluids. To this extent at least, the opsonic index is a valuable guide along the path of vaccine therapy, the clinical landmarks of which are none too plain. Experience alone can tell us how much we may rely on this form of laboratory guide.

#### **The Application of Bacterial Therapy In Disease. Tuberculin Immunization.**

We have already seen that high degrees of bacterial immunity may be produced in otherwise susceptible animals by repeated injections of dead or attenuated bacteria. In man, this observation has been put to practical use in the prophylactic injections of vaccine prepared from the organisms of cholera, bubonic plague, and typhoid fever. In regions where these diseases are endemic, the incidence of the diseases in those who receive the injections is much less than in other untreated individuals under like conditions of hygiene and exposure.

Bacterial therapy as developed up to the present time in the cure of diseases is of value chiefly in chronic localized infections such as staphylococcus infections of the skin, tuberculosis and other infections of bones and joints, sinuses, etc. In these there is but little absorption of bacterial products, and consequently there is relatively slight reaction to the infection on the part of the body. The injection of killed cultures of bacteria appears to be a rational means of increasing this reaction and augmenting active immunity with a resulting acceleration in healing of the lesion.

*Tuberculin Immunization.* Ever since the introduction of tuberculin by Koch, it has been used therapeutically in the various forms of tuberculosis. In the early years, enormous doses, 50 mg. and more, were used, often with disastrous results. These cases caused a widespread opposition to tuberculin, and it is only comparatively recently that it has again come into general use. Now however, we employ minimal doses, .001 mg. at the outset, increasing the dose later as the condition of the patient warrants. Several forms of tuberculin are employed for immunizing purposes. The new tuberculin, T. R., may be taken as a general type. It contains the residue of bacilli obtained by centrifugalization of an aqueous suspension of bacilli which have previously been dried and ground to a fine powder. This bacillary residue, from which much of the soluble toxic portion has been removed, is suspended in glycerin and water, so that 1 c.c. of the tuberculin (T. R.) contains .001 gm. of bacilli. The tuberculin is diluted with salt solution, or with an aqueous solution of glycerin shortly before use. Dilutions older than 2 or 3 weeks should not be used. Be-

ginning with a dose of .001 mg., the injections are given at intervals of 2 or 3 days to a week. Some prefer to keep the dose at .001 mg. for some time. Others give gradually increasing doses ranging up to 1. mg. v. Hippel<sup>9</sup> has reported cures in 23 cases of tuberculous iritis, and 3 cases of tuberculous conjunctivitis in which he used gradually increasing doses of T. R. beginning with .002 mg., and increasing to 1 mg. By this method favorable results have been obtained in tuberculous affections of the lids and conjunctiva, in keratitis, iritis, scleritis, choroiditis and retinitis of tuberculous origin by Reunert,<sup>8</sup> Dorschlag,<sup>10</sup> Wolfrum,<sup>11</sup> Ziegler,<sup>12</sup> Rohmer,<sup>13</sup> Kraemer,<sup>14</sup> and others.

Trudeau<sup>15</sup> who has made a careful study covering a long period of years of tuberculin immunization in pulmonary tuberculosis suggests certain principles by which the dosage and interval of injections can be gauged by the clinical symptoms. Clinical reactions, either febrile, local at the site of the lesion, or at the site of injection, or constitutional symptoms as malaise, anorexia, nausea, languor, sleeplessness, wandering pains and loss of weight are to be avoided. To this end the initial dose is very small and is increased gradually; should a reaction occur treatment is at once suspended until all symptoms have subsided and then resumed with the smaller gradually increasing doses. Denys who employs old tuberculin prepares 8 solutions. No. 1 contains .0001 mg. per cubic centimeter; No. 2 contains .001 mg.; No. 3, .01 mg.; No. 4, .1 mg.; No. 5, 1 mg.; No. 6, 10 mg.; No. 7, 100 mg.; No. 8, 1 cc. or pure tuberculin (liquid measure). Solution No. 1 is used in febrile cases only. In non-febrile cases, beginning with .1 c.c. of No. 2 the dose is increased by .1 c.c. given at intervals of 4 or 5 days until 1 c.c. is reached; then .1 c.c. of No. 3 is given, increased at each dose by .1 c.c., and so on. The period of immunization extends over a number of months, during which in favorable cases the condition of the patient progressively improves. Other forms of tuberculin such as T. R. may be used in the same way, bearing in mind that in the old tuberculin the dilution is calculated on the basis of liquid measure, while in T. R., 1 c.c. of the tuberculin contains 1 mg. of dried bacilli.

The final word as to the value of tuberculin immunization cannot yet be spoken. Many competent observers feel that it is of distinct value in combination with other hygienic and tonic treatment. Trudeau finds from a study of the post-discharge mortality of the Saranac Sanitarium covering a period of 15 years, that from 18 to 25 per cent. more of treated than of untreated cases were living at the time the report was written. On the other hand certain workers including Meissen in Germany deny that tuberculin has any curative value.

The treatment of tuberculosis of bones and joints, etc., offers somewhat less difficulty than does that of pulmonary tuberculosis. Severe reactions are less frequently met with, and there is consequently less interruption of the progressive immunization. In genito-urinary tuberculosis, the results of immunization have been very encouraging in certain cases.

Spengler<sup>16</sup> holds that the toxins of the human and bovine tubercle bacilli are more or less mutually antagonistic, and in cases infected with one form, he employs a vaccine prepared from the other, with reported good results. His work has not as yet been confirmed.

#### **Active Immunization in Staphylococcus, Streptococcus and Other Infections.**

The chronic pus infections of the skin, such as acne and furunculosis offer one of the best fields for the demonstration of the value of bacterial therapy. Certain of these cases, intractable to other methods of treatment have yielded to injections of killed cultures of the associated organisms. In some cases good results are obtained with stock vaccines, but it is usually found of advantage to prepare the vaccine from the autogenous organism. Different strains of staphylococci even though resembling each other in cultural characteristics may differ widely in toxicity and in their power of producing immunizing responses in a given individual and it is hence desirable to use for immunization a culture obtained from the lesion under treatment. Two or more organisms may be associated in a lesion, such as a sinus, and here we may immunize against one organism, and then the other, causing each to disappear in turn. Thus favorable results are reported in chronic suppurations of the accessory sinuses of the frontal and ethmoid bones.

Grey-Edwards<sup>17</sup> found staphylococcic vaccine of value in 3 cases of hypopyon ulcer, and Maddox<sup>18</sup> reports good results from vaccine in a staphylococcus infection after cataract operation.

Immunization in pneumococcus infections has so far not been attended with any permanent benefit. Römer has suggested the combination of active immunization with passive serum immunization in serpiginous ulcer, but no conclusive data are at hand as to the value of the method.

In ulcerative endocarditis of staphylococcus, streptococcus and pneumococcus origin, injections of vaccines prepared from the autogenous organisms have so far not been successful in curing the disease. One case is reported by Wright in which the injections of vaccines was followed by recovery, but there is some question as to whether the symptoms were not due to sepsis, without active ulceration of the heart



valves. There seems to be no doubt however that a temporary period of clinical improvement follows the injections in some instances, so that we are justified in adopting the treatment in this class of cases, so hopeless under other therapy.

In chronic gonococcus infections, gonococcus vaccines have apparently been of value in hastening the healing of arthritis and other metastatic lesions.<sup>19 20</sup> In gonococcus infections of the mucous membranes, vaccines have usually been of little value, although Allen<sup>21</sup> reports successful cases in conjunctivitis in adults.

#### **Serum Reactions in Diagnosis.**

We have already seen that immune sera contain a number of antibodies such as the agglutinins in typhoid which may be utilized in the diagnosis of otherwise obscure infections. The work of Wright on opsonins opens another somewhat parallel road to diagnosis. In normal individuals the opsonic index for the tubercle bacillus usually varies within certain narrow limits (.8-12). If the opsonic curve is abnormally low (i. e., phagocytosis is less in the patient's serum mixture than in the normal pool serum mixture which is regarded as unity), Wright claims that tuberculous infection is present. Likewise, high tuberculo-opsonic indices or curves showing marked high and low fluctuations from day to day are indicative of tuberculosis. Following massage of an affected part, or after exercise, etc., the appearance of a marked rise or fall in a previously normal index is also regarded as further evidence of infection. The method has been applied in the same way to infections due to the staphylococcus, streptococcus, gonococcus, etc. The diagnosis of a joint lesion may lie between tuberculous and gonococcal arthritis. A normal tuberculo-opsonic index and a low or fluctuating gonococco-opsonic index indicates the gonococcal origin of the lesion.

In the hands of carefully trained workers, the method undoubtedly furnishes valuable corroborative evidence in diagnosis. Wright and others have reported many instances in which the diagnostic value of opsonic determinations was demonstrated by the subsequent course of the cases. It is well however to reserve final opinion until further work has determined the limitations as well as the possibilities of the procedure.

#### **Fixation of Complement—The Bordet-Gengou Phenomenon.**

If red blood corpuscles of one species (of the sheep for instance) are injected repeatedly into an animal of another species (such as the rabbit) the serum of the rabbit is found to contain substances which dissolve or hemolyse sheep's corpuscles. Hemolytic serum heated to 60° C. becomes inactive, but can be reactivated by the addition of a



small amount of normal serum. The amboceptors or immune bodies of the hemolytic serum combine with the complement of the normal serum and the red cells, and hemolysis results. Such a combination is known as a hemolytic system. Bordet observed that if he added normal serum to sensitized red cells, and then after waiting until hemolysis took place added this normal serum to the red cells of a second species which had been sensitized by the addition of a corresponding hemolytic serum, hemolysis of the red cells did not take place. The complement of the normal serum had been taken up or "fixed" by the first system, and hence there was no free complement available to complete the second hemolytic system.

The Bordet-Gengou phenomenon is a further development of these observations and is utilized in determining whether a given serum contains certain antibodies or amboceptors. The serum to be tested is heated to destroy its complement. A small amount of normal serum is then added together with a suspension of the organism whose antibodies it is desired to find. The mixture is incubated for a short time and then is added to red cells sensitized with heated hemolytic serum. If the test serum contains the specific amboceptors or antibodies no hemolysis results, for the complement of the normal serum is promptly "fixed" or bound to the bacteria, and hence is not available for the hemolytic system. If, however, there are no immune bodies in the test serum, by which complement may be bound to the bacteria, the complement remains free and on the addition of the hemolytic system, completes the hemolytic reaction. The attempt has been made to use this reaction in the identification of various bacteria particularly the meningococcus and gonococcus.

Wasserman<sup>22</sup> has proposed the application of the test in the diagnosis of syphilis. An alcoholic or salt solution extract of syphilitic liver is substituted for the bacterial suspension, and the test carried out as above, using the patient's serum heated to destroy its complement, and adding a small amount of normal serum to supply the complement necessary for the test. On adding the hemolytic system, no hemolysis results if the patient's serum contains syphilitic antibodies or amboceptors, for they furnish the bond by which all the available complement in the added normal serum is united to the antigens of the syphilitic organ extract and none is left for the hemolytic system. If on the other hand no antibodies are present in the patient's serum, the complement of the normal serum remains free to unite with the hemolytic system, and hemolysis follows. Wasserman's results have been confirmed by several observers. Positive results have been obtained in about 90 per cent. of cases with active syphilitic processes, 50-60 per

cent. of latent cases, and in 75 per cent. of parasymphilitic affections such as tabes and paralytic dementia.

#### **Bacterial Reactions in Diagnosis.**

*Koch's Tuberculin Reaction.* Practically the only bacterial reaction which has been utilized for diagnostic purposes is that with tuberculin. This was first developed by Koch, who found that a hypodermic injection of a small amount of tuberculin in a case of tuberculosis was followed in a few hours by a rise in temperature, headache, malaise and anorexia. The method with restrictions as to dose, etc., has been widely practised, and has come to be regarded as the standard for estimating the accuracy of other tests.

Briefly, the procedure is as follows: The patient is carefully examined for physical evidence of tuberculosis. Cases of active tuberculosis, or suspected cases in which high fever is present should not be subjected to the test. If possible the subject of a tuberculin test should be at rest in bed during the period. In suitable cases the temperature is taken every two hours for a period of 2 days. A solution of old tuberculin in water to which .5 per cent. carbolic acid has been added is prepared so that 1 c.c. of the solution contains 1 mg. of tuberculin. In the afternoon, or in slightly febrile cases, in the evening, 1 mg. of tuberculin is given hypodermically. A positive reaction is signalized by a rise in temperature, headache and malaise. In severe reactions, there may be chill, nausea, vomiting, and severe prostration, the symptoms persisting for 24 hours or more. Associated with the constitutional symptoms, there is frequently marked redness, swelling, and tenderness at the site of the injection, and where the lesion is accessible to observation, as in the eye, injection of the vessels and increased exudation.

In cases showing no reaction, a second injection of 1 mg., or after waiting a day 2 mg., may be given. If there is then no reaction, a further dose of 5 mg. may be used. If no reaction follows, the test is regarded as negative. Most clinicians prefer not to use diagnostic doses larger than 5 mg, on account of the danger of severe reactions, with rapid extension of the tuberculous process which has occasionally followed the use of large doses.

In cases of undoubted tuberculosis the reaction has been obtained in from 95 to 100 per cent. In suspected cases there is a considerable variation in the per cent. of positive results in the tables of different workers, due in part no doubt to the personal equation involved in the estimation of symptoms necessary to constitute "probable" or "possible" tuberculosis. In general, experience teaches that Koch's tuberculin reaction has a high grade of diagnostic value.

**v. Pirquet's Cutaneous Tuberculin Reaction.**

In his work on vaccination against smallpox, v. Pirquet observed that frequently a decided hyperemia developed at the site of a revaccination in cases previously successfully vaccinated. This observation, coupled with the results of his studies on the phenomena of serum hypersusceptibility or "serum sickness" suggested to him the possibility of a bacterial hypersusceptibility in the subjects of bacterial infection, which might be employed in diagnosis. In 1907 he published the results of his studies on the cutaneous tuberculin reaction.<sup>23</sup>

v. Pirquet applied a small drop of tuberculin to the skin, and through the drop, scarified a small area, avoiding any bleeding. After 24 hours an area of hyperemia appeared, in the center of which a small papule developed, which slowly subsided after a few days. Control scarifications produced no reaction. He later modified the method by making a series of scarifications using several dilutions of the tuberculin. His first paper summarized 360 observations mainly on children. In 88 per cent. of tuberculous cases he obtained a positive reaction. In the advanced cases, and in miliary tuberculosis the reaction did not appear. In 100 cases in which post mortems were obtained, 47 were found tuberculous, and of these 30 had given the reaction; the other 17 were either advanced or miliary cases. Of the 53 non-tuberculous cases, only one had given a positive reaction.

The work of v. Pirquet was taken up by a number of other observers, and his results were in the main confirmed. It appeared, however, that in the cases classed as "suspected" and "non-tuberculous," the reaction was positive in a larger proportion of cases than the clinical manifestations warranted, i. e., the test reacted to healed or latent tubercle, and hence was too delicate to be of practical value. By limiting more rigorously the definition of a "positive reaction," the ultra delicacy of the test has been largely done away with, and the cutaneous reaction of v. Pirquet bids fair to become a valuable aid in diagnosis.

**Calmette's Ophthalmo-tuberculin Reaction.**

Shortly after the publication of the observation of Wolff-Eisner, that the instillation of tuberculin into the eyes of patients with tuberculosis produced a decided conjunctival hyperemia and exudation, Calmette<sup>24</sup> reported a series of observations on tuberculous and non-tuberculous patients and showed that the reaction is typical and specific. The test is performed with old tuberculin which has been precipitated by alcohol, dried and redissolved in water.

One drop of a 1 per cent. solution is instilled into the conjunctival sac. In 3 to 8 hours a varying degree of hyperemia appears, accom-

panied by some lachrymation and subjective irritation. The hyperemia reaches its maximum in about 24 hours and then gradually subsides. Frequently there is pronounced exudation and occasionally oedema of the lids and surrounding tissues. Baldwin<sup>25</sup> has suggested the following schema for recording the reactions:

Negative—No difference in color when both eyelids are pulled down and compared.

Doubtful—Slight difference with redness of the caruncle.

+—Distinct palpebral redness with secretion.

++—Ocular and palpebral redness with secretion well marked.

+++—Deep injection of entire conjunctiva with oedema of lids, photophobia and secretion.

As in the case of the cutaneous reaction of v. Pirquet, positive reactions have been obtained in many cases not suspected on clinical grounds of being tuberculous. The frequency with which the reaction is found in supposedly non-tuberculous individuals calls to mind post-mortem statistics in which it has been found that in over 90 per cent. of individuals dying from all causes, some trace of tuberculosis such as apical scars, etc., is found. In drawing conclusions from the ophthalmic as well as from the cutaneous and other tuberculin tests we must be guided not only by the specific reaction, but also by the other clinical findings.

The following table compiled by Hay<sup>26</sup> summarizes the comparative results reported by some twenty observers, using the methods of Koch, v. Pirquet, and Calmette.

		Total No. of Cases.	Positive Reaction.	Percentage.
Tuberculous Cases	Koch* ....	....	....	100.
	Pirquet ...	291	237	81.5
	Calmette ..	1419	1191	88.8
Suspected Cases	Koch* ....	....	....	88.6
	Pirquet ...	281	208	79.0
	Calmette ..	516	268	51.9
Non-Tuberculous Cases.	Koch* ....	....	....	55.5
	Pirquet ...	418	250	59.8
	Calmette ..	1320	204	15.4

The easy technique of the ophthalmic tuberculin test renders it particularly attractive as a means of diagnosis. It should be remembered, however, that it is not entirely without danger, and tuberculin even in dilute solution should not be indiscriminately instilled into the eyes of

\*Frankel and Beck's statistics.

patients. Care must be taken that the test is carried out only in normal eyes.

The instillation of tuberculin often gives rise to a local hyper-susceptibility to tuberculin, and hence a second instillation should not be made into the same eye. In comparison with the thousands of ophthalmic tests, the accidents with Calmette's reaction have been relatively few. There are however a considerable number of cases on record in which the reaction has been attended by corneal ulceration, keratitis, etc., with permanent injury to vision, even in healthy eyes. (Knapp,<sup>27</sup> Wiens and Günther, <sup>28</sup> Pollard.<sup>29</sup>)

Citron<sup>30</sup> outlines certain restrictions to the use of the test; the reaction should not be tried unnecessarily in scrofulous children, in persons exposed to conditions which may easily cause inflammation, in districts where trachoma is prevalent, in patients who have been tested before, in patients under treatment with tuberculin, in cases where one eye is or has been diseased, and in cases where the diagnosis is clinically certain.

#### Moro's Inunction Tuberculin Reaction.

The application of the tuberculin test by inunction has been proposed by several workers, and Moro,<sup>31</sup> by whose name the procedure has come to be known, found that he obtained results approximating in accuracy those of the v. Pirquet method. A salve composed of equal parts of lanolin and old tuberculin is rubbed into a small area of skin preferably the chest or abdomen. Within a few hours a diffuse redness appears, with later development of papules, the reaction remaining a week or 10 days.

Kanitz<sup>32</sup> has tried the reaction in a series of cases, and compares the results with those obtained with the Calmette and v. Pirquet reactions in the same patients. His figures given in the table below are not so favorable to the inunction method as are those of Moro. Further work will undoubtedly indicate modifications by which the several procedures may be made to yield more harmonious results.

Comparison of the Tuberculin Reactions of Calmette, v. Pirquet and Moro.

	Cases	Calmette or V. Pirquet Reaction		Moro Reaction	
		+	-	+	-
Tuberculosis . . .	78	72=92.5%	6= 7.5%	28=35.9%	50=64.1%
Suspected Tuberculosis }	16	14=87.5%	2=12.5%	9=56.2%	7=43.8%
Not Clinically Tuberculosis }	53	27=50.9%	26=49.1%	7=13.2%	46=86.8%

**The Ophthalmalmo-typhoid Reaction.**

In 1907 Chantemesse<sup>33</sup> proposed the ophthalmalmo-typhoid reaction for the diagnosis of typhoid fever. Chantemesse prepared an aqueous extract of typhoid bacilli, precipitated this with alcohol and redissolved the precipitate in sterile water. The instillation of one drop of this solution into the eyes of typhoid patients was followed in a few hours by hyperemia of the conjunctiva, and in some instances by lachrymation and slight exudation, the entire reaction lasting 24 to 36 hours. In 78 cases of typhoid fever which gave the agglutination test, the reaction was obtained in all. In eight of these the reaction was obtained while the agglutination test was still negative. In 50 cases of disease other than typhoid, the reaction was negative, though in some there occurred a slight hyperemia lasting 4 or 5 hours. The reaction has been obtained as early as the fifth day, and Chantemesse suggests the possibility of utilizing it for early diagnosis in cases in which the agglutination reaction is delayed.

Hamburger,<sup>34</sup> working with an aqueous extract of typhoid bacilli, obtained a positive reaction in all of 27 cases which gave positive blood cultures or agglutination tests. The usual duration of the reaction was 48 to 72 hours. Of 15 control cases, five gave no reaction, 7 showed a slight conjunctival hyperemia which disappeared in 24 hours, and in 3 the hyperemia persisted more than 24 hours, though in these the reaction was not so marked as in the typical typhoid cases. So far, no untoward results following the test have been reported.

**Other Bacterial Reactions Based on the Phenomena of Hypersusceptibility.**

As our knowledge of the relations of foreign proteids in the animal body increases, it becomes more evident that we are only beginning to learn the possibilities in serum and bacterial diagnosis.

Much light has been thrown on the reactions of bacterial proteids by the extensive researches of Otto, Rosenau and Anderson, Gay and Southard, and others on the phenomenon of hypersusceptibility or anaphylaxis observed in animals following the injection of foreign proteids. If a small amount of horse serum for example is injected into guinea pigs, and then after a period of 10 days or more a second injection is given, the animals exhibit severe nervous and respiratory symptoms, and frequently die within a few minutes. If however the second injection is given within a few hours of the first, no symptoms appear. Vaughan has observed analogous phenomena following the injections of small quantities of bacterial proteids.

R. Kraus<sup>35</sup> has recently published a series of experiments in which he was able to show that a condition of hypersusceptibility to bacterial



proteids can be produced in guinea pigs by the injection of emulsions of the dead organisms of the dysentery bacillus, staphylococcus, and even of some of the non-pathogenic bacteria, so that subsequent injections of the corresponding organisms made after the lapse of 10 to 20 days, caused severe symptoms and death within a few minutes, while control animals receiving the same dose were unaffected. These observations are very suggestive as affording a possible explanation of the various phenomena of the tuberculin test, particularly those of the ocular and cutaneous reactions. In man, the work along this line has been confined chiefly to tuberculosis. During the past two years, however, in the course of the investigations on vaccine therapy, reactions of a similar character have been encountered following injections of the gonococcus, and also of colon bacillus and other organisms. This phase of bacterial diagnosis awaits further investigation.

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# CHAPTER XI.

## A SCHEME FOR THE SYSTEMATIC EXAMINATION OF THE EYES OF SCHOOL CHILDREN.

BY FRANK ALLPORT, M. D., CHICAGO.

*The Need of Preventive Procedures—The Frequency of Eye, Ear, Nose and Throat Diseases Among School Children—The Necessity for Normal Sight and Hearing—The Ease with Which Eye and Ear Defects Can Be Detected by School Teachers—The Advisability of Annual Examinations at Stated Periods—The Vermont Law on the Subject—A Visual Chart with Teachers' Instructions Appended.*

Modern medical movement emphasizes preventive procedures. The early detection of disease renders its cure probable. Unrecognized and neglected infirmities often become incurable. Education opposes ignorance, filth and vice. Disease militates against educational acquirements. The early recognition of disease, joined with intelligent medical interference, will minimize sickness, ignorance and crime.

Juvenile pathological conditions obviously prevail amongst the ignorant poor whose physical, moral and social uplift can be best reached through the auspices of their great gathering places, the public schools.

Authority and law, aided by educational inspection, should compel the regular physical examination of scholars, supplemented by proper medical or surgical intervention.

There are about 20,000,000 school children in the United States; about 8,000,000 have ocular defects; about 8,000,000 have ear, nose or throat defects. Therefore, about 16,000,000, or 80 per cent., are more or less impeded in educational progress by eye, ear, nose or throat defects. Such defects can usually be easily detected, and either cured or relieved.

Seven hundred million dollars are invested in school properties in the United States. The full value of this investment can only be guaranteed when the physical condition of the pupils render them capable of profiting by offered instruction.

It costs about \$15,000,000 annually to care for 300,000 blind people in the United States, most of whom are blind through ignorance and lack of intelligent medical supervision.

Correct sight and hearing are essential to the absorption of presented instruction. Children are frequently considered stupid who have visual or aural defects, and are subsequently proven to be bright and intelligent when such infirmities are corrected.

*The presence of eye and ear lesions in school children is easily discovered.* Such investigations may be readily made by teachers, by following the instructions to be given later. Teachers can make these examinations without fear or hesitation; they cannot diagnose the disease but they can easily ascertain the fact of its presence; the physician consulted will do the rest. Although the tests will consume some time once a year, in the end they will save much of the teacher's time, labor and patience in transforming apparently stupid children into normal children.

The tests should be made annually, at the beginning of the Fall term, and should include all children above the first grade. Each teacher should examine the children in her own room. By thus subdividing the work and devoting one day, or even half a day to it, all the children in a city can be examined in that length of time. The necessary material for making the tests consists of the testing charts, including the teacher's instructions, short reference blanks, and the "Warning Cards" for parents. The charts may be purchased of F. A. Hardy & Co., 131 Wabash Avenue, Chicago, Ill., and the blanks and "Warning Cards" may be printed in the home city. The cost is slight and immaterial.

The tests are now being used quite universally and their use is required by law in Vermont, Connecticut and Massachusetts. The Vermont law, which is the best, reads as follows:

Section I. The State Board of Health and the superintendent of education shall prepare or cause to be prepared suitable test cards, blanks, record books, and other needful appliances to be used in testing the sight and hearing of pupils in public schools, and necessary instructions for their use; and the Superintendent of Education shall furnish the same free of expense to every school in the state. The superintendent, principal, or teacher in every school during the month of September in each year shall test the sight and hearing of all pupils under his charge, and keep a record of such examinations according to the instructions furnished, and shall notify in writing the parent or guardian of every pupil who shall be found to have any defect of vision or hearing, or disease of eyes or ears, with a brief statement of such defect or disease, and shall make a written report of all such examinations to the Superintendent of Education as he may require.

REDUCED CUT.  
 ●  
 VISION CHART FOR SCHOOLS  
 PUBLISHED BY F. A. HARDY & CO., CHICAGO, ILL.  
 SNELLEN'S

CC

E

200

C

B C

100

LXX

N L D

70

L

R T P E

50

XL

E Z F B D

40

XXX

C T L G F O

30

XX

E O P Z F R D A

20

(This line should be read by a normal eye at 20 feet.)

(Detach by breaking on this line.)

INSTRUCTIONS FOR THE EXAMINATION OF SCHOOL CHILDREN'S  
 EYES AND EARS. ETC.

Section II. The State Auditor is hereby directed to draw his order on the State Treasurer for such sums and at such times as the Superintendent of Education, with the approval of the State Board of Health, may require to carry out the provisions of this act. The total expense under this act shall not exceed Six Hundred (\$600.00) Dollars in any biennial term ending June 30.

Section III. This act shall take effect July 1, 1905.

It is recommended that all legislatures pass this law.

There can, of course, be no reasonable objection to an examination of the eyes and ears of school children by regularly appointed eye and ear surgeons, or by medical school inspectors. This would, however, necessarily cost considerable money, and usually produces much professional friction. The tests can be sufficiently well done by school-teachers, without extra expense, and all things considered, this is the best plan.

A cut of the Vision Chart, with teacher's instructions, is here appended.

## FOR USE OF PRINCIPALS, TEACHERS, ETC.

Do not expose the card except when in use, as familiarity with its face leads children to learn the letters "by heart."

First grade children need not be examined.

The examinations should be made privately and singly.

Children already wearing glasses should be tested with such glasses properly adjusted on the face.

Place the "Vision Chart for Schools" (Snellen's) on the wall in a good light; do not allow the face of the card to be covered with glass.

The line marked XX (20) should be seen at twenty feet, therefore place the pupil twenty feet from the card.

Each eye should be examined separately.

Hold a card over one eye while the other is being examined. Do not press upon the covered eye, as the pressure might induce an incorrect examination.

Have the pupil begin at the top of the test card and read aloud down as far as he can, first with one eye and then with the other.

## FACTS TO BE ASCERTAINED.

1. Does the pupil habitually suffer from inflamed lids or eyes?
2. Does the pupil fail to read a majority of the letters in the number XX (20) line of the Snellen's Test Types, with either eye?
3. Do the eyes and head habitually grow weary and painful after study?
4. Does the pupil appear to be "cross-eyed"?
5. Does the pupil complain of ear-ache in either ear?
6. Does matter (pus) or a foul odor proceed from either ear?
7. Does the pupil fail to hear an ordinary voice at twenty feet in a quiet room? Each ear should be tested by having the pupil hold his hand over first one ear, and then the other. The pupil should close his eyes during the test.
8. Is the pupil frequently subject to "colds in the head" and discharges from the nose and throat?
9. Is the pupil an habitual "mouth breather"?

If an affirmative answer is found to any of these questions, the pupil should be given a printed card of warning to be handed to the parent, which should read something like this:

## CARD OF WARNING TO PARENTS.

*After due consideration it is believed that your child has some Eye, Ear, Nose and Throat disease; for which your family physician or some specialist should be at once consulted. It is earnestly requested that this matter be not neglected.*

*Respectfully,*

*School.*

If only an eye disease is suspected, the words "ear, nose and throat" should be crossed off; if only an ear disease is suspected, the words "eye, nose and throat" should be crossed off; if it is only a nose and throat disease, the words "eye and ear" should be crossed off.

It will be observed that these cards are non-obligatory in their nature. They do not require anything of the parent, who is at perfect liberty to take notice of the warning card or not, as he sees fit. They simply warn the parent that a probable disease exists, thus placing the responsibility upon the parent.

Nevertheless, if parents neglect the warning thus conveyed, the teacher should, from time to time, endeavor to convince such parents of the advisability of medical counsel. Teachers are urged to impress upon pupils and parents the necessity for consulting reputable physicians.

These tests should be made annually at the beginning of the Fall term, and should include all children above the first grade.

Each teacher should examine all the children in his or her own room, and should report the results of such examinations to the principal, such reports to be signed by the examining teacher.

The following simple form of report, to be filled out by the teacher and handed to the principal, is suggested and may be printed upon paper of any size and character that is deemed advisable by the local school authorities, and should be distributed to the different room teachers.

No.	NAME OF PUPIL.	Do the tests indicate an Eye, Ear, Nose or Throat Disease? Answer "Yes" or "No." If so, which?	Was the pupil given a Card of Warning?
1	John Doe	Yes Eye	Yes
2	Robert Smith	Yes Ear	Yes
3	Mary Brown	No	No
4	Edward Hart	Yes Nose or Throat	Yes

## CHAPTER XII.

### EXAMINATION OF SOLDIERS, SAILORS, PILOTS, RAILROAD EMPLOYEES AND OTHER CORPORATION EMPLOYEES AS A PROOF OF EFFICIENCY AND AS A PREVENTIVE OF ACCIDENTS AND INJURIES.

BY NELSON M. BLACK, M. D., MILWAUKEE, WIS.

*Block Signal System—Control of Trains—Necessity for the Best Vision and Perfect Color Sense—Conditions About Engine Interfering with Vision—Atmospheric Conditions Interfering with Vision—Other Factors Interfering with Signal Interpretation—Examinations—Rules of New York Central System—Table of Visual Standards—Special Features of Rules—Apparatus Needed for Examination—Methods of Conducting Examination—Rules for Examination of Color Sense with Holmgren's Worsteds—Rules for Using Holmgren's Color Worsteds as Simplified by Doctor Thomson—Rules for Using William's Lantern—Rules for Field Test—Value of Office Tests—Comparison of Test Card Vision with Field Test Vision—Value of Field Tests—Advantages and Disadvantages of Glasses for Protection and to Increase Vision in Railway Service—Amber Lenses—Rules for Visual Examination United States Army—Rules for Visual Examination United States Navy—Rules for Visual Examination Pilots, Masters and Mates Marine Service—Rules for Visual Examination of Employees of Milwaukee Electric Railway Company.*

In order to maintain the speed at which we now travel, especially by rail, some means to indicate whether the track ahead is unoccupied is absolutely necessary. The result has been the Block signal system which has been installed by practically all railways and by many of the suburban and interurban electric roads.

This system of controlling trains requires, in the daytime, the determination of the position of a semaphore arm about 4 feet long by 6 inches wide, or distinguishing the color of a disc about 17 inches in diameter, displayed on a pole about 26 feet high. At night the color of a six inch lens, lighted by a kerosene lamp, must be observed. These observations must be made by the enginemen at sufficient distance within which to control their trains. Mr. R. Quayle, Superintendent of Motive Power of the Chicago & Northwestern Railway, kindly furnished the following data, which are the result of some recent experiments in controlling fast trains:



With the ordinary break, 70 pounds train-line pressure, a six-car train running 70 miles an hour can be stopped inside of 2,000 feet, approximately 1,900 feet, and when the high speed brake 110 pounds train-line pressure, is used on the same train and running at the same speed, the train can be stopped in 1,450 feet.

It will be seen that the significance of a signal must be determined at not much less than one-half mile (2,640 feet), as a few seconds are necessary for the engineman to shut off his steam and apply his air, and in each one of these seconds a train, traveling 70 miles an hour, is covering 88 feet.

There is no question that next to the necessary practical knowledge of his engine, the vision and color perception of the engineman is the most important.

There are so many conditions that severely test the best vision and



Fig. 19.—Home and distant signals, home signal clear, distant stop.

color sense that a person with these faculties diminished to even a small extent is a source of danger, consequently the best known standard of binocular single vision and color perception is none too good, and it must be quick vision.

Conditions existing about an engine, such as the escape of steam when an injector is used, when the whistle is blown, from leaking valves or connections, from the poorly packed piston rods of air pumps, cylinders and steam chests, will often completely envelop the engine and cab. Steam and soot from the smoke-stack is often blown back against the cab windows, covering them with moisture and dirt and making it next to impossible to see through them, to say nothing of obtaining a view of anything through the condensed steam and smoke. This is especially true in passing under the viaducts or

bridges entering the railroad yards of large cities, where there are many moving engines and trains, and signals must be closely watched. In freezing weather the escaping steam is especially bad, as the windows are coated with ice, and vision through them is out of the question. The dust raised by passing trains often coats the windows, especially if they are damp from escaping steam; the engineman's position, being on the right side, escapes most of this, however, on roads which run their trains right-handed on double tracks. The cloud raised from ploughing through snow drifts shuts off all vision



Fig. 20—English type of semaphore and signal tower, Waterloo Station, London.

for the time. Some considerable complaint is made of the drivers throwing mud and dirt on the front windows in moist weather.

The glare from the furnace door when the engine is stoked makes the reading of night signals much more difficult. There is an iron shield above the furnace door on the engineman's side, which protects him somewhat. Many enginemen have their seats curtained off to relieve them of this glare. After looking into this glow from the position of a fireman during the time required to shovel in five or six shovels of coal, it is an utter impossibility for a novice to read a signal. Firemen state they cannot even see their steam gauge for several seconds after a stoking, and when one takes into consideration

that from three to ten tons of coal are handled in a two to five-hour's run, there is not much let up from looking into the fire-box, and when this is done daily for five or six years, or even longer, before a fireman can expect to become an engineman it must be a good pair of eyes that can stand it, without some protection.

The constant jarring, swaying and rolling of an engine traveling at a high rate of speed, is another factor in making signal reading difficult.

The constant supervision of an engine takes no small part of an engineman's time and attention, and his duties are far more than sitting on the seat and watching for signals. This is especially true



Fig. 21—German type of semaphore.

when there is any trouble with the various mechanisms under his care.

Certain atmospheric conditions are not only a source of great annoyance in reading signals, but often completely obscure them at a distance sufficient within which to control a train. Fog, snow, mist and rain take precedence in the order given, and when it is necessary for better vision to have the head out of the cab window the impinging of the fine particles of snow, mist or rain against the eyes blinds one almost instantly. The force of the wind when running at a high rate of speed causes the tears to flow and blurs the vision after a very short exposure.

Night signals are seen at a greater distance than day signals in these atmospheric conditions.

The foreground and the background of day signals make a great difference with their being easily seen. A sky background is the

ideal; the kind of day does not seem to make much difference. Signals displayed on roads running through mountainous country, and especially where there are many curves in valleys, are very hard to distinguish from the elevated position on either side. Woods stripped of their leaves or in full foliage; the proximity of buildings and bridges; all tend to make the position of signals less distinct, while the cross-bars of telegraph poles are very confusing. Undoubtedly night signals are much easier read, as the contrast is so much greater, but as to their being seen any farther, or so far, atmospheric conditions being the same, is questionable.

The reflection from snow, from a body of water, from the solid green of foliage, running toward the sun when near the horizon, the shimmer in the atmosphere on hot summer days, all are features which add much to the difficulty of seeing signals.

Thus it will be seen from the factors enumerated above, those requiring good vision and those tending to interfere with it, the best known standard of binocular single vision and color perception is none too good, and not only must a man have this, but it must be "quick vision," for he may for an instant be able to see through some break in the interfering media, and must be able to read his signals in that instant.

#### **Examinations.**

Practically all the railroads of the United States and many of the electric roads have adopted a very thorough system of examining candidates for employment and re-examination of old employees. There has, however, been no uniformity in the requirements, each road selecting, or having selected for it by some recognized authority, certain requirements of vision and color perception regarded as safe. The methods of examination and test objects used differ but little, the lack of uniformity being in what different roads construe as a sufficiently safe standard. Through the efforts of such men as Drs. B. Joy Jefferies, Wm. Thomson, Frank Allport, Chas. H. Williams, Chas. A. Oliver, H. B. Young and others, the standards of not only visual requirements but physical and educational requirements have been raised.

The committee on Safety Appliances of the American Railway Association about four years ago reported unanimously on "Rules Governing the Determination of Physical and Educational Qualifications of Employees." These were adopted by the Association April 5, 1905.

There was considerable leeway allowed in these rules. This undoubtedly was for the purpose of giving the various roads time to

swing into line, as too decided changes could not be expected to be adopted at once, this being the first step of the American Railway Association in this direction.

The rules adopted by the New York Central System February 1, 1908, are the most comprehensive, thorough and fair to the employees I have seen. They are herewith copied in full:

**New York Central System.**

*Rules Governing the Determination of Visual Acuity, Color Perception and Hearing.*

RULE 1.—Each person selected to make examinations must first be examined and instructed by an oculist designated by the Company.

RULE 2.—Each examiner should be provided with:

*a* A set of Snellen's test types, with at least three cards of each size of letters shown in different combinations (a single line on each card), for testing acuteness of vision.

*b* An American Railway Association standard reading card for testing near vision.

*c* A Holmgren or Thomson color-selection test, and instructions for use of same.

*d* A "Williams" lantern, or one similarly constructed, and instructions for use of same.

*e* A pair of spectacles, or shade, for testing each eye separately.

*f* A triple grooved trial frame with one pair of plus two diopter lenses, one pair of plus one diopter lenses, and one pair of plane glass roundels.

*g* Blank forms for examinations, and certificates.

RULE 3.—Examinations should be conducted in a room, or car, in which a distance of twenty feet can be measured from test type, or face of lantern, to candidate; shades or curtains should be provided in order to darken room, or car, for lantern test.

RULE 4.—In testing vision, color perception and hearing, only the person to be examined and the examiners should be in the room or car at the time, except that if an employe so desires, he shall be permitted to call in another employe who has successfully passed to witness the examination.

RULE 5.—*a* The result of each examination must be shown in duplicate on the prescribed form, one copy to be preserved for reference by the examiners, the other to be forwarded to the division superintendent for inspection, record and file.

*b* Those charged with the duty of making examinations on each division must keep proper check to insure re-examination of all employees when due, and must see that all employees who should be examined by an expert or oculist under the rules, are required to take such examinations promptly, and that all glasses to be used by employees are sent to the oculist for approval as per rule 11.

*c* Examiners will issue to each person who passes a satisfactory examination, a certificate to that effect, and will, if desired, furnish employees who fail to pass, a written statement of their rating and cause of failure.

*d* Division Superintendent must report to the General Superintendent all cases wherein an employe should be examined by committee, or appears to be disqualified, giving full information as to result of examination.

*e* Oculists or experts will report result of their examinations to the Division Superintendent.

RULE 6.—All persons desiring to enter the service (applicants) must take entrance examination without the use of glasses for distant vision, excepting Class E.

RULE 7.—Applicants for entrance to service as Enginemen, Firemen, Trainmen or Brakemen, will not be accepted if they have to use glasses for near vision. Applicants for other positions, and employees in all branches of the service, may use glasses for near vision when undergoing examination.

RULE 8.—When the distant vision of an employe can be improved by the aid of glasses, he should wear them, except yard brakemen, who are prohibited from doing so.

RULE 9.—All employees who require the aid of glasses for distant vision must wear them at all times when on duty and must carry a duplicate pair for use in case of emergency, and will be examined with each pair.

RULE 10.—All employees, excepting those indoors, who are permitted to wear glasses for distant vision, when on duty, must use the spectacle or automobile goggle form. There is no objection to the use of automobile goggles fitted with glass for protection of the eyes in engine or freight train service. The use of amber glasses by firemen, as a guard against temporary fire blindness, is encouraged.

RULE 11.—Glasses of all kinds must be approved by an oculist designated by the Company.

RULE 12.—Applicants having a squint, or who are cross-eyed, will not



be accepted. Examiners who suspect a case of double vision should use some simple test to determine its presence.

RULE 13.—Enginemen who have less than 20-30 vision in either eye, without glasses, must be examined by an expert or by an oculist designated by the Company.

RULE 14.—Enginemen in Class A, who fail to reach required standard, must be examined by a committee of two, appointed by the General Superintendent, and upon recommendation of this committee they may be permitted to wear glasses, provided their combined vision can be brought to 20-20; committee to recommend service to which they may be assigned.

RULE 15.—Enginemen in Class B, whose vision without glasses is less than 20-50, and either eye less than 20-70, or nil, must be examined by a committee of two, appointed by the General Superintendent, and if the vision by the aid of glasses can be brought to 20-30, must wear glasses; committee to recommend service to which they may be assigned. See rules 13 and 16.

RULE 16.—Enginemen having 20-20 vision in one eye and less than 20-70, or nil, in the other, must be examined by a committee of two, appointed by the General Superintendent; committee to recommend the service to which they may be assigned.

RULE 17.—Where promotion standard is not specified, employees applying for transfer from one kind of service to another, or being promoted, must pass entrance examination of class they desire to enter, except that those who have been injured in service, or who have been in continuous service for at least two years, may be transferred to positions as hostlers, switch tenders and crossing flagmen; also from one position to another under Class E, upon passing the respective re-examination standards.

RULE 18.—An employe in Class C, D, E, or F, who has been in continuous service for a period of not less than fifteen years, and who, through diminution of vision, or muscular imbalance, fails to reach required standard, will be considered satisfactory if his acuteness of vision, with or without glasses, reaches the maximum standard specified for the class of service in which he is employed.

RULE 19.—The test type should be in good light, the bottom of the card about on a level with the eye. Place the candidate twenty feet from the card and ask him to read the type



with both eyes open, then cover one of his eyes with a card, or shade, held firmly against the nose, taking care not to let it press the eye-ball, and instruct him to read with the other eye such type as may be indicated. Each eye should be tested separately.

*a* Examiners are reminded that the normal-eyed should read the twenty-foot (or 6 meter) letters at 20 feet, in which case the visual power should be expressed by the fraction 20-20. Should a candidate be unable to read the twenty-foot letters at 20 feet, but be able to read the thirty-foot letters, result should be indicated by the fraction 20-30. If he can only read the forty-foot letters record should be 20-40, etc.

*b* The candidate, as provided in Rule No. 7, must be able to read the print in paragraph No. 2 of the Standard Card at a distance of from fourteen to eighteen inches to pass the test. Further tests should be made by having the candidate read written train orders.

**RULE 20.**—Applicants for entrance to service in Classes A and C, will undergo additional test to ascertain if far-sighted to the extent of two diopters. Examiners will use combinations in trial frame representing plane and convex lenses, varying the test so that a candidate's former experience or knowledge obtained from others may be valueless. If an applicant reads without difficulty the twenty-foot letters at 20 feet through convex lenses of 2D, he will not be considered satisfactory.

**RULE 21.**—Examiners will adhere to instructions laid down by Holmgren or Thomson in using color-selecting test, and will examine the color-sense of each eye separately. Further examinations will be made with Williams lantern, or one similarly constructed, in the manner specified by Dr. Williams.

**RULE 22.**—No applicant will be accepted into the service, and no employe retained in any of the classes specified in following standards, who has defective color-sense.

**RULE 23.**—No employe will be disqualified from service by reason of defective color-sense without an examination by an oculist designated by the Company.

**RULE 24.**—In examination of hearing (which will be with human voice) each ear will be tested separately, and the candidate should not see the movement of examiner's lip.

RULE 25.—Applicants for entrance to service must be able to hear and repeat an ordinary conversation, or names and numbers spoken in a conversational tone, at a distance of 20 feet, in which case the hearing should be expressed by the fraction 20-20. Where conversation can be heard at only 10 feet, the hearing should be expressed by the fraction 10-20.

RULE 26.—Employees will not be retained in the service if hearing is less than 15-20 in one ear and 5-20 in the other; or less than 10-20 in each ear.

RULE 27.—Employees included in the standard of vision must be re-examined as follows:

*a* All classes every two years.

*b* Employees in engine, train or yard service, who wear glasses for distant vision, enginemen having less than 20-30 vision in either eye, and other employees who have less than 20-70 vision in either eye, must be examined annually.

*c* After any accident, in which they are concerned, which may have been caused by defective vision, color sense or hearing.

*d* After any serious accident or illness or severe inflammation of the eye or eyelids.

*e* Before promotion.

*f* Employees with hearing less than 20-20 in either ear must be examined semi-annually.

RULE 28.—*a* Employees in Class A or B, who are examined by a committee, shall be given an outside or field test. A bracket pole with two dolls or two straight poles (spaced the same distance as dolls on the standard bracket pole), carrying four standard semaphore arms and lights will be used. A clear sky back-ground, tests to be made standing.

*b* In making the test candidates should approach the signals from a point where they are unable to see them and not be credited with being able to read the signals unless they can promptly call changes as made in position of arms and color of lights.

*c* The test with and without glasses should be made at distances varying from 5,000 to 200 feet.

*d* Committee to record the different distances at which the employee being examined can promptly see the signals, and will forward this information, together with their recommendation as to the service to which he may be assigned, to the General Superintendent.

## STANDARDS OF VISUAL ACUITY

### INDOORS TESTS

CLASS	Entrance to Service	PROMOTION	RE-EXAMINATION
CLASS A Enginemen, road service. Hostlers who run on main track.	20-20 combined, not less than 20-30 in either eye, without glasses. Must not accept a plus 2 D lens.	20-20 combined and not less than 20-40 in either eye without glasses.	20-20 combined, not less than 20-70 in either eye; or 20-30 combined, not less than 20-40 in either eye, without glasses. See rules 8, 13, 14 and 16.
CLASS B Enginemen, yard service. Hostlers who do not run on main track.			20-30 combined, not less than 20-50 in either eye, without glasses. When combined vision without glasses is not less than 20-50, and neither eye less than 20-70, and by the aid of glasses combined vision can be brought to no less than 20-30, enginemen must wear glasses. See rules 8, 9, 10, 11, 13, 15, and 16.
CLASS C Firemen. Trainmen. Freight Brakemen. Yard Brakemen. Switchtenders.	20-20 combined, and in each eye, tested separately, without glasses. Must not accept a plus 2 D lens.	20-30 combined, not less than 20-40 in either eye, without glasses.	20-30 combined, not less than 20-40 in either eye, with or without glasses, providing neither eye is less than 20-70 without glasses; or 20-20 in one eye and less than 20-70 or nil in the other, without glasses. See rule 8—(Yard Brakemen).
CLASS D Passenger Conductors. Freight Conductors Yardmasters Train Baggage men	20-20 combined, not less than 20-30 in either eye, without glasses.	20-30 combined, not less than 20-40 in either eye, without glasses.	20-40 combined, not less than 20-50 in either eye, with or without glasses; or 20-30 combined, not less than 20-70 in either eye, with or without glasses; or 20-20 in one eye and less than 20-70 or nil in the other, without glasses.
CLASS E Station Agents. Telegraph Operators Signal Foremen. Signalmen. Bridge Foremen. Track Foremen. Drawbridge Tenders Car and Engine Inspectors.	20-30 combined, not less than 20-40 in either eye, with or without glasses.	(See Rule 17.)	20-30 combined, not less than 20-70 in either eye, with or without glasses; or 20-30 in one eye and less than 20-70 or nil in the other, without glasses.
CLASS F Crossing Flagmen and Gatemen.	20-40 combined or not less than 20-50 in either eye, without glasses.	(See Rule 17.)	20-50 combined, not less than 20-70 in either eye, with or without glasses; or 20-40 in one eye and less than 20-70 or nil in the other, without glasses.

### FIELD TESTS

CLASS		WITHOUT GLASSES	WITH GLASSES
CLASS A Enginemen, road service.	By day, sunlight. Or by day if cloudy, with clear atmosphere. By night.	200, 400 and 2,600 feet. 200, 400 and 2,000 feet. 200, 400 and 2,000 feet.	200, 400 and 5,000 feet. 200, 400 and 4,000 feet. 200, 400 and 4,000 feet.
CLASS B Enginemen, yard service.	By day or night.	200, 400 and 800 feet.	200, 400 and 2,600 feet.

Attention is directed to the following rules:

Rule 1 aims to raise the standard of those conducting the examinations which, in lieu of having an ophthalmic surgeon do all the examining, is a step forward.

Rule 2 (a) calls for a selection of charts with a single line upon each chart which precludes the candidate committing the letters to memory. Section (f) provides to a large extent against hyperopes of 2 diopters or over gaining entrance into service.

Rule 4 tends to inspire the candidates for examination with more



Fig. 22—Disc block signal.

confidence, as they are suspicious and many think they are not treated fairly when examined alone.

Rule 5 insures those in service who fall below the requirements an examination by the company's oculist. Second, the glasses worn by employees must be correct and meet with the company's regulations.

Rule 5 (c) overcomes a great deal of dissatisfaction by giving those failing in an examination a written statement of their rating and cause of failure.

Rules 8 and 10, by advising the use of glasses for improving distant vision, for protection of the eyes and of amber lenses as a

protection to firemen, the company is looking to the preservation of the eyes and vision of its employees.

The report of the benefit department of the Brotherhood of Locomotive Engineers shows that 36 enginemen lost an eye while on duty in railroad service from September 1, 1906, to September 1, 1907.

This does not include the other departments of railway service. The protection afforded by glasses certainly would have reduced this number to some extent.

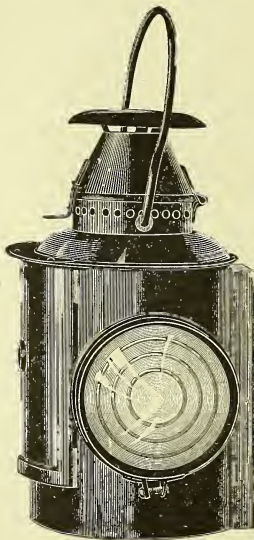


Fig. 23—Adams, Westlake & Co.'s non-sweating ventilation semaphore lamp, with corrugated lens. The source of illumination for night signaling.

Rule 13 keeps the standard for enginemen high: those having less than 20-30 vision in either eye without glasses being required to be examined by the company oculist. While in Rules 14 and 15 those who fail to reach the required standard of that class are given an examination by a committee and permitted to wear glasses if vision can be brought to 20-20 or 20-30, depending upon class of service.

Rule 20 tends to eliminate latent hyperopes.

Rule 21 requires examiners to adhere to the rules laid down by

Holmgren in carrying out the examination. Holmgren's worsted test and all modifications of it are strictly comparison tests. Its use in any other manner than that laid down by its author makes it valueless. It is the failure to carry out the test as directed that causes so many to pronounce it inefficient. The fact that such is the case is sufficient reason for Rule 23, i. e., "No employe will be disqualified from service by reason of defective color sense without an examination by an oculist designated by the company."

Rule 27 requires the re-examination of all classes included in the standards of vision every two years.

(b) Employes in engine, train or yard service, who wear glasses for distant vision, enginemmen having less than 20-30 vision in either eye, and other employes who have lost less than 20-70 vision in either eye, must be examined annually.

(c) After any accident in which they are concerned, which may have been caused by defective vision, color sense or hearing.

(d) After any serious accident or illness or inflammation of the eye or eyelids.

(e) Before promotion.

#### **Method of Conducting the Examination of the Vision and Color Perception of Railway Employes.**

Each examiner should be provided with:

(a) A set of Snellen's test types, with at least three cards of each size of letters shown in different combinations (a single card on each line) for testing acuteness of vision.

(b) An American Railway Association standard reading card for testing near vision.

(c) A Holmgren or Thomson color-selection test, and instructions for use of same,

(d) A William's lantern, or one similarly constructed, and instructions for use of same.

(e) A pair of spectacles, or shade, for testing each eye separately.

(f) A triple grooved trial frame with one pair of plus two diopter lenses, one pair of plus one diopter lenses, and one pair of plane glass roundels.

Examinations should be conducted in a room or car, in which a distance of twenty feet can be measured from test type, or face of lantern, to candidate; shades or curtains should be provided in order to darken room or car for lantern test.

Description (kindly furnished by Ophthalmic-Surgeon Walter R. Parker) of the car used by the Michigan Central R. R. in making the examination of employes for vision, color sense, and hearing.



An ordinary day coach was partially dismantled by taking out all the seats except eight, which are left at one end of the coach to serve as a waiting room. Just forward of the seats, 15 feet from rear end of car, leaving room to pass out of the hallway at the side, a partition was built from the side of the coach to the partition which runs lengthwise of the car 25 inches from the side. At a distance of 9 feet 9 inches from the front of the car a partition was built across from the side to the hall partition, forming a small L-shaped room, which is used as a dark room. The windows were carefully covered and an oil lamp was set in a swinging bracket. Doors are so arranged that employes enter the testing-room from the waiting-room, and after the examination is completed may pass out into the hallway and out of the front of the car, thus preventing intercourse with the un-examined.

In testing the color sense in the day time by the use of the Williams' lantern it is necessary to hang the lantern in the dark room opposite the door. By the means of ordinary curtains in the testing-room, the room will be made dark enough for accurate results.

The test type should be in good light, the bottom of the card about on a level with the eye. Place the candidate twenty feet from the card and ask him to read the type with both eyes open, then cover one of his eyes with a card or shade, held firmly against the nose, taking care not to let it press the eyeball, and instruct him to read with the other eye such type as may be indicated. Each eye should be tested separately.

Examiners are reminded that the normal eye should read the twenty-foot (or 6 meter) letters at twenty feet, in which case the visual power should be expressed by the fraction 20-20. Should a candidate be unable to read the twenty-foot letters at twenty feet, but be able to read the thirty-foot letters, results should be indicated by the fraction 20-30. If he can only read the forty-foot letters record should be 20-40, etc.

Applicants for entrance to service in Classes A and C will undergo additional tests to ascertain if far-sighted to the extent of two diopters. Examiners will use combination in trial frame representing plane and convex lenses, varying the test so that a candidate's former experience, or knowledge obtained from others, may be valueless. If an applicant read without difficulty the twenty-foot letters at twenty feet through convex lenses of 2D, he will not be considered satisfactory.

Examiners will adhere to the instructions laid down by Holmgren or Thomson in using color selection tests and will examine the color-



sense of each eye separately. Further examination will be made with Williams' lantern, or one similarly constructed, in the manner specified by Dr. Williams.

"Railroad officials, deceived by the seeming simplicity of the method, often allow section foremen to conduct the examination. They receive a small stock of worsted, selected at random and often proceed to test the color by pulling out a single thread and asking the man to name the color. Even physicians often allow the candidate to critically compare the skeins which in itself should be a sufficient indication of defect." In a report made by committee of the British Ophthalmological Society appears the following: "Your committee becomes more and more convinced that a competent examiner is not made in a day or month, and that even with large experience much judgment and capacity are needful to interpret rightly the acts of the examined."—(Jennings *Color Vision*).

**Rules for Examination of Color Sense With Holmgren Worsted.**

(Jennings "*Color Vision and Color Blindness*.")

*First Test:*

The worsted is placed in a confused heap on a large, plane surface, in a good light; the match skein, of *light pure green* (neither a blue or a yellow-green), is taken from the pile and laid to one side. The candidate is requested to select the other skeins most resembling it in color and place them by the side of the sample. We must explain that resemblance in every respect is not necessary, that there are no two skeins exactly alike, and that an endeavor must be made to find something similar of a lighter or darker shade. He is not to compare narrowly or to rummage much among the heap, but to select with his eyes and to use his hands chiefly to change the position of the selected skeins. If he does not understand, we must ourselves make the trial by searching with our own hands for the skeins. After we have shown in a practical manner what we want him to do we must restore the whole to the pile, except the sample skein. If a large number are to be examined, we can save time by instructing all at once and allowing them to observe the examination of those preceding them. This assists the normal-eyed in making his selection quickly, without, on the other hand conveying any information to the defective by which he can avoid making the characteristic mistakes of the color blind. A person with a *normal color-sense* will pick out the lighter and darker shades of green rapidly and without hesitation. He may perhaps include in his choice a few green skeins inclining to yellow or blue; but this is no evidence of color-blindness, but rather a lack of practice with colors. The *completely color-blind*, whether to red or green, will

select, with or without the greens, some confusion colors—grays, drabs, stone colors, fawns, pinks or yellows. The *incompletely color-blind*, or those with a *feeble chromatic sense*, will add to the selection of greens one or more light fawns or grays; or they may pick out a skein, hesitate, add it to the greens and then withdraw it, and so on.

When confusion colors have been selected, we know that the candidate is either completely or incompletely color-blind. In order to determine its nature and degree we employ a second test.

#### *Second Test:*

The worsted is mixed again and a skein of rose is laid to one side. The candidate is requested to pick out all the lighter and darker shades of this color. The color-blind always select deeper colors. Those who by the first test were found to have a *feeble chromatic sense* will make no mistakes in this test.

The *incompletely color-blind* will match the rose with deeper purples.

The *completely color-blind* will select blue or violet, either with or without purple.

The *completely green-blind* take green or gray, or one alone, either with or without the purple.

The *violet-blind* show a strong tendency to select blue in the first test, and red and orange, either with or without purple in the second test.

While the diagnosis of violet-blindness is difficult it is also very rare.

As we have decided the character and degree of the defect, it is not necessary to resort to the third test; but as the red skein used corresponds to the danger signal it may occasionally be of value in convincing the officials and other persons that the candidate is unfit for duty.

#### *Third Test:*

The sample for this test is a skein of *bright red*, to be used in the same way as the green and rose. The *red-blind* select besides the red, green and brown shades darker than the red. The *green-blind* select green and brown shades lighter than the red. Only marked cases of color-blindness will show their defect with this test.

*The following are the rules for using Holmgren's color worsted as simplified by Dr. Thomson:*

"The test consists of two different sets of worsteds, which must always be kept apart, not only in their corresponding part of the box, but also in testing men. The first set consists of a large green sample skein, and twenty small skeins, each marked with a bangle

having a concealed number extending from one to twenty. Among these numbers odd ones are different shades of green, while the even numbers are grays, light browns, etc. The second set consists of a large rose sample skein and twenty small skeins which are numbered from 21 to 40. Here the odd numbers are different shades of rose color, while the ten even numbers consist of blues, greens and grays. The worsted is to be kept from the light in the double box, one side of which is colored green and the other rose, to aid the examiner in keeping the series separate.

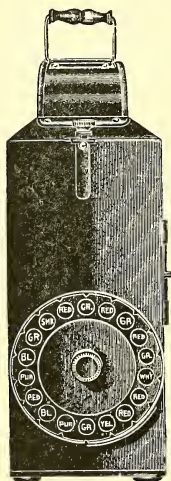


Fig. 24—Dr. Charles H. Williams' lantern for testing color vision.

In testing the worsted is taken from the green part of the box and placed upon a table in a confused mass. The candidate is requested to select ten tints to match the large green skein. When this is done and the numbers recorded the worsted is removed and the examiner proceeds with the second set. For the use of the surgical expert two more large test skeins have been added; one, C, yellow, and the other, D, blue. The test C is exposed, and the candidate is asked to match it, if possible, from the skeins 1 to 20. If normal in color-sense he will decline, or at the most only take the yellow-green skein; but if color blind he will select a number of the green skeins, which

should be recorded. Then use test D, the blue skein, and let him match it from skeins 21 to 40. If normal or green-blind he will select blues only, but if red-blind he will pick out a series of roses, which should be recorded."

*The rules for using Williams' lantern are as follows:*

"The room being darkened, light both burners of the lamp and place the lantern 20 feet from the person to be examined, and on a level with his head, the side of the lantern carrying the disc with the colored glasses facing directly toward him. Place the sliding shutter, regulated by the knob at the upper part of the lantern, so that two lights are shown at the same time, with the full sized openings. Ask the person being examined to call aloud the name of each of the colors shown, and designate their positions, for instance, 'left green, right red,' then turn the disc with the glasses (not too rapidly) until all the colors have been shown. In case it is preferred the man who is being examined may call out the meaning of the color shown him instead of its name, for instance, 'left light starboard, right light port,' or, for railway service, 'left light safety (if that is its use on the road, or caution), right light danger.' The examiner will make note, as the examination proceeds, of the small illuminated number under the color shown and of the name given to this color, thus '9 green, 11 red.' In case a wrong name is given to any color it is convenient for reference to make a note, on a different part of the record, of this number and its true color. After showing all the colors with the largest opening, raise the shutter so as to show only one light at a time through the smallest opening, and make note as before of the numbers shown and the names given to each color. If desired, the colors may be tested through the medium-sized opening, and with one or two lights showing, but it will generally be sufficient, for routine tests, to use first two lights with the largest opening, and then one light with the smallest opening.

"If a person calls a red light green, or a green light red, or, if he calls a danger signal safety, or a safety signal danger, under any of the conditions of the lantern test, it shows his color perception is so defective that he cannot be considered a safe man for any position where he will be required to use color signals.

"If he calls a green light blue, or a yellow light red, it is not to be considered as a serious mistake; or, if with the smallest opening he cannot see any distinct color in the No. 7 (cobalt blue), which transmits less light than most of the other colors, let it pass without insisting on his giving a name to it, and note on the record under this number, 'no name given'; but a confusion of red and green is fatal."

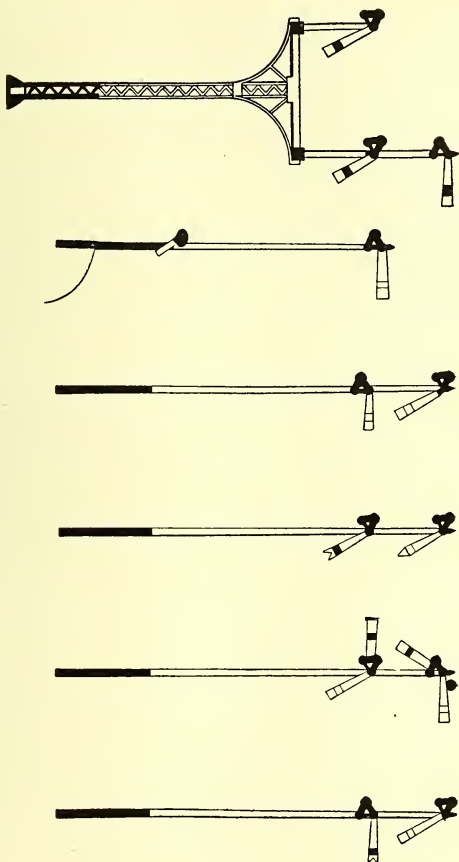


Fig. 25—The author's new semaphore charts for testing vision of railroad employes. Made by F. A. Hardy & Co. These are printed in the colors used in railway signal work upon a neutral gray background.

**Rules for Field Test.**

Employees in Class A or B, who are examined by a committee, shall be given an outside or field test. A bracket pole with two dolls or two straight poles (spaced the same distance as dolls on the standard bracket pole), carrying four standard semaphore arms and lights will be used. A clear sky background, tests to be made standing.

In making the tests candidates should approach the signals from a point where they are unable to see them and not be credited with being able to read the signals unless they can promptly call changes as made in position of arms and color of lights.

The test with and without glasses should be made at distances varying from 5,000 to 200 feet.

Committee to record the different distances at which the employee being examined can promptly see the signals, and will forward this information, together with their recommendation as to the service to which he may be assigned, to the General Superintendent.

**Value of Office Tests.**

The value of office tests for railway employees has been questioned by some reliable ophthalmologists, who state that field tests "should invariably be used, for without the lamps and flags there is practically no means of detecting the 'chronic myopes'—the short-sightedness for color; and without the flags and semaphores there is only theoretical knowledge of the visual acuteness."

"With the office card test the effect of different backgrounds, only in a limited way, can be studied and the same may be said of illumination to represent different atmospheric conditions. Moreover, it gives no adequate idea of the possibility that a 20-20 in one man is better than 20-20 in another through better papillary control in varying conditions of illumination and background. The best control means the best vision.

"Card vision of 20-20 is desirable, but it is not necessarily a high type of vision. As compared with 20-15, possessed by a goodly number, it is *prima facie* defective; and with some of the many 20-30 people it may be the same, because of slow mentality. Least of all it should be called 'standard' or 'normal.'"

Another ophthalmologist says, "No system of examination should be based on the visual standards of oculists, as they are for scientific work and are not always practicable. The system should be based on the actual road conditions, first determining what the engineer and firemen have to observe, then establishing the minimum allowable. On many of the roads the day signals have been standardized and the night lights are supposed to have a uniform intensity. These stand-

ards are based on what the normal eye can see at one-half mile or beyond. In a majority of cases why are engineers and firemen wearing glasses? "In many cases it is because they have run up against an examination and found that their vision did not come up to the standard of 20-20. They were given to understand that their vision must be corrected by glasses, and on goes the correction, for no better reason than that they could not see certain letters under conditions which have no relation to their every-day work. They did not put on glasses because they could not recognize signals on the road day or night. They were not examined under working conditions or anything approaching it, but the test was unnatural and under unfamiliar surroundings and they were advised to wear glasses by someone not any too well versed in the requirements of railway men."

This to a large extent is true, as will be shown by the following report, which was the result of an official field test made of enginemen long in service, whose distant vision as shown by the card test had become very much reduced.

The remarkable visual acuity evidenced by these individuals in the field tests shows the effect of training, habitual usage and environment which has been commented upon by Super, who concludes that savages are not superior to civilized men in visual acuity, but rather in being educated to observe and interpret what they see.

"This" (says the *Ophthalmic Year Book*, 1908) "confirms the impression gained from clinical experience, that much of the failure of vision spoken of as senile, is really pathologic, and caused by excessive demands in the way of near vision and by abnormal general conditions incident to civilized life."

The field tests above referred to were made with the men upon an engine so they were practically under the same conditions as when on duty.

A semaphore signal was installed with a clear sky background. Intervals were marked off each 100 feet up to 6,000 feet, the engine run toward the signal, the individual being examined, stating the indication of the signal as soon as it became visible to him.

No. 1. Age 52. Service 30 years. Engineman 26 years.

Vision O. D. 20-50. With Glasses Vision O. D. 20-30.

Vision O. S. 20-50. With Glasses Vision O. S. 20-30.

Vision Combined 20-40. With Glasses Vision Combined 20-30.

Semaphores O. D. Without Glasses 1,700 ft. plain.

Semaphores O. S. Without Glasses 2,600 ft. plain.

Semaphores Combined. Without Glasses 2,100 ft. plain.

Smoky and hazy, also getting dark, 6:10 p. m.



*No. 2. Age 56. Engineman 38 years.*

Vision O. D. 20-70. With Glasses Vision O. D. 20-20.

Vision O. S. 20-40. With Glasses Vision O. S. 20-20.

Vision Combined 20-40. With Glasses Vision Combined 20-20.

Semaphores O. D. Without Glasses 3,400 ft.

Semaphores O. S. Without Glasses 3,200 ft.

Semaphores Combined. Without Glasses 3,400 ft.

Second test running toward semaphores.

Semaphores O. D. Without Glasses 3,950 ft.

Semaphores Combined. Without Glasses 3,950 ft.

*No. 3. Age 65. Service 31 years. Engineman 28 years.*

Vision O. D. 20-70. With Glasses Vision O. D. 20-20.

Vision O. S. 20-100. With Glasses Vision O. S. 20-20.

Vision Combined 20-50. With Glasses Vision Combined 20-20.

Semaphores O. D. Without Glasses 3,100 ft.

Semaphores O. S. Without Glasses 2,500 ft.

With Glasses Normal.\*

*No. 4. Age 51. Service 29 years. Engineman 21 years.*

Vision O. D. 20-100. With Glasses Vision O. D. 20-20.

Vision O. S. 20-70. With Glasses Vision O. S. 20-20.

Vision Combined 20-70. With Glasses Vision Combined 20-20.

Semaphores O. D. Without Glasses 1,600 ft.

Semaphores O. S. Without Glasses 3,250 ft.

Semaphores Combined. Without Glasses 3,350 ft.

*No. 5. Age 66. Service 34 years. Engineman 28 years.*

Vision O. D. 20-100. With Glasses Vision O. D. 20-20.

Vision O. S. 20-100. With Glasses Vision O. S. 20-20.

Vision Combined 20-70. With Glasses Vision Combined 20-20.

Semaphores O. S. Without Glasses 2,640 ft.

Semaphores Combined. Without Glasses 3,000 ft.

*No. 6. Service 29 years. Engineman 20 years.*

Vision O. D. 20-100.

Vision O. S. 20-100.

Vision Combined 20-100.

Semaphores O. D. Without Glasses Running 1,900 ft.

Semaphores O. D. Without Glasses Standing 2,100 ft.

Semaphores O. S. Without Glasses Running 2,100 ft.

Semaphores O. S. Without Glasses Standing 2,400 ft.

Semaphores Combined. Without Glasses Standing 3,500 ft.

Second Test.

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\*Determination of signal at 1 mile was considered normal.

Semaphores Combined. Without Glasses Standing 3,900 ft.

Semaphores Combined. Without Glasses Running 3,900 ft.

Semaphores Combined. With Glasses 6,000 ft.

Which greatest distance tried.

*No. 7. Age 50. Service 28 years. Engineman 25 years.*

Vision O. D. 20-20.

Vision O. S. 20-200. Does not wear glasses.

Semaphores O. S. Without Glasses 1,850 ft.

*No. 8. Engineman 25 years.*

Vision O. D. 20-200. With Glasses Vision O. D. 20-20.

Vision O. S. 20-200. With Glasses Vision O. S. 20-40.

Vision Combined 20-200. With Glasses Vision Combined 20-20.

Semaphores O. D. Without Glasses 2,000 ft.

Semaphores O. S. Without Glasses 2,000 ft.

Semaphores Combined. Without Glasses, Standing 2,000 ft.

Semaphores Combined. Without Glasses, Running 1,800 ft.

Semaphores Combined. With Glasses, one mile.

The reduction of vision in the above reported cases in the majority of instances was due to latent hyperopia becoming manifest with increasing age. The distance at which the correct interpretation of the signal indications were determined are certainly remarkable and demonstrates Super's conclusion that distant vision is to a large extent a condition of being educated to observe and interpret what one sees.

#### **Value of Field Tests.**

The value of field tests is certainly demonstrated in the reports on preceding pages. It is, however, a superfluous test with those having 20-20 vision; except as a night test for the purpose of detecting "Chronic myopes."

An official of one of our largest railway systems volunteered the information, that the night field test was frequently tried with those showing color defects with the Holmgren and lantern tests and that invariably the same character of defect was demonstrated by the field test.

The enginemen, as a rule, would certainly prefer a field test to an office examination, as it would more nearly simulate actual working conditions. There are, however, several objections to this method; in the first place it consumes so much time; secondly, the roads would hardly go to the expense of building a testing line of sufficient length for such a purpose, and the congested condition of the traffic on the majority of the roads would not warrant the undertaking of such a

method, as, in order to carry out the scheme fully, the examiner would have to arrange before hand for designated signals to be in certain positions; thirdly, there would have to be a test for signals by night as well as by day; fourthly, the tests would not be equal, for some men would be tested under perfect weather conditions and others under adverse. The result is, we must be content with an office or inside test. The exception being those cases especially referred for such a test.

#### **Advantages and Disadvantages of Glasses for Protection and to Increase Vision in Railway Service.**

It is a well known fact that men entering the railway service at from eighteen to twenty-five years of age may possess from 1—4 D. of latent hypermetropia and a considerable amount of astigmatism, and be able to pass the required examinations, as they are now conducted, with ease, the muscle of accommodation being able to overcome the latent refractive error. These men on coming up for re-examination five, ten and fifteen years later will be unable to meet the required standard of vision because of a reduction in accommodative power from increasing years. They are at their most useful time of life in all other respects, their experience resulting from long years of training and the caution acquired with advancing years, more than compensates for the loss in vision, and when it can be brought up to the standard required with glasses, renders them far more useful and safe men than those with perfect eyesight and less experience.

With the vision of these men raised to the required standard and protected from wind, dust, mist, rain, snow and sleet by glasses, it stands to reason they are safe men, safer in fact than the man with standard vision who has less experience and unprotected eyes.

The objections raised to enginemen wearing glasses are not many, but on first thought may seem serious.

- 1st. Becoming smeared and dirty.
- 2d. Becoming covered with fog, mist, rain or snow.
- 3d. Becoming fogged on coming from cold into warmth.
- 4th. The danger of glasses being broken.
- 5th. "That glasses which give a visual acuity of  $\frac{20}{20}$  in the examining room do not give an equivalent visual acuity of  $\frac{20}{20}$  when used at very long ranges, particularly under certain climatic conditions."

- 6th. The legal aspect in case of accident.

From my experience too much cannot be said in favor of enginemen and firemen wearing glasses, either for protection or when long in service, to correct refractive errors.

The following are some of the distinct advantages of glasses:

- 1st. The correction of refractive errors of men long in service.
- 2d. Protection against wind, dust, mist, rain, snow and sleet.
- 3d. Relieving the reflection when running beside rivers or lakes, from snow in the winter and sand in western deserts.
- 4th. Overcoming the disturbance of vision when running toward the rising or setting sun.
- 5th. Doing away with the heat and glare from the fire-box in stoking.

The men who make the fast runs with our "limited" trains, have been advanced to such duties by a process of selection, a sort of "survival of the fittest." The experience attained, ability to meet the increasing demands of his occupation, and the additional caution acquired, are all results of his long years of service, and in reality are what have secured him his position and entitled him to hold it. *These qualifications without good vision endanger life and property*, but with his vision brought up to the required standard by the use of lenses, he has the knowledge that his past record has entitled him to the respect and trust of the officials of his road to spur him to the best performance of his duties.

The protection afforded the eyes by glasses against the impact of wind, dust, rain, snow and sleet, when an engine is traveling from 35 to 70 miles an hour, can only be appreciated by one who has experienced it, and it is absolutely necessary for an engineman to have his head out of the cab window more or less, in order to be sure of his signals in such weather conditions. Fully 90 per cent. of the enginemen I have ridden with carry some sort of protection glasses for such emergencies.

The objectionable reflection from snow, and while running beside bodies of water, the disturbance of vision when running toward the rising or setting sun, and the relief from the heat and glare of the fire-box, is naturally accomplished by use of colored glasses. All colors were tried; the best and only satisfactory result was obtained with the amber lenses. With this color before the eyes there is a seeming, if not absolute increase in the vision. Objects of like hue at a distance stand out distinct and plain—for instance a semaphore signal with a bad background. One can look indefinitely into the fire-box and see all its parts, relieved of the heat and glare, and then climb up on the cab seat and distinguish signals with ease, the scotoma produced by looking into the bright fire with the naked eye being absent.

The protection of firemen's eyes seems of especial importance

to me for the reason that the engineman almost always calls on his fireman to verify signals located at points of importance or where the signal is somewhat obscure; and with the scotoma produced in the naked eye from the fire-box this is almost impossible.

The colors of the night signals used in railroading that have to be recognized at a distance—red, white, green and yellow—are not affected by the amber lens to any extent. The white is tinged a slight yellow; the yellow is made a deeper yellow; the green, especially if it contains much blue in its composition, is made a more decided green on account of the yellow in the amber being a complimentary color of the blue and neutralizing same. The red is absolutely unaffected. The blue lights used for back lights, and on some roads to designate car repairing, are considerably diminished by the amber lenses, but this color is not used for the control of trains in block systems. The blue and violet rays of the spectrum are the chemically active rays and the ones which cause irritation of the fundus and diminution of vision when the eyes are exposed to them for any length of time. The amber lenses neutralize these rays and so protect the eyes from them.

**Rules for the Visual Examination for Entering the United States Army.**

"The epitome of Tipler's manual and other publications on the Examination of Recruits" is the official guide, and the following extract refers to the eyes:

The following are causes for absolute rejection:

Loss of either eye.

Chronic inflammation of the lids, when they are red and swollen with a collection of more or less dried matter on the edges between and around the lashes; the ball of the eye will also be "bloodshot."

Myopia (near-sightedness).

Hypermetropia (over-sightedness), except when moderate and free from organic disease.

Astigmatism.

Inability to read or describe with facility the types or characters on the test cards. This examination requires the greatest care and patience on the part of the recruiting officer; it is made with cards bearing the twenty-foot test-types and test-characters. To use the cards, measure off a distance of twenty feet in a straight line, place the applicant with his back to the light at one end of the line, while the examiner stands at the other and holds the card exhibiting the test types or characters in full view of the applicant so that a good light falls on the card. Each eye should be examined separately, one being covered with a card (not with the hand) by the assistant, who,

standing behind the applicant directs him to read the types on the card held by the examiner; if he cannot read, the card bearing the characters is presented to him, which he is directed to describe. The types should be read first from left to right; the characters should be described as to the numbers of arms seen on each and the direction in which they are pointed, whether upward or downward, to the right or left.

If the applicant should be unable to read the test-types or describe the test-characters correctly with either eye he must be rejected.

This standard for vision may be departed from in the examination of candidates for appointment into the Medical Corps of the Army and in the enlistment of members of the Hospital Corps, and the applicants who are the subjects of refractive errors, viz., myopia, hypermetropia, presbyopia and astigmatism, provided these errors are not excessive, may be entirely corrected by glasses and are not progressive or accompanied by ocular disease.

The object of this test is to exclude from the service men whose visual defects are such as to prevent them from becoming marksmen. Successful use by the soldier of long-range fire-arms demands that his vision shall be normal or so nearly normal that there need be no question of his ability to see the target at all ordinary ranges.

A large percentage of men are the subjects of slight visual defects, not to such extent as to disqualify them for military duty, but sufficient to cause a little blurring or indistinctness in some of the letters of the required test, which may be increased by the nervous apprehension of failure. Ignorance, fear or stupidity on the part of the applicant are factors to be considered in making this examination, and unless the recruiting officer exercises sound judgment he will probably reject men whose vision is in reality good, hence plenty of time should be taken and slight errors such as reading a P or T for an F, provided the majority of the test letters or test characters are read with facility, need not be regarded as a failure of the test.

The cards used at recruiting stations for testing vision should be kept locked up when not in use or otherwise protected from access by prospective recruits. In all doubtful cases a small paddle with a hole in it of such size as to expose only one letter at a time should be used; such a device, intelligently used, would make memorizing of no avail.

*In time of war* none of the defects mentioned above as disqualifying in time of peace should exempt conscripts from service save those caused by extreme refractive errors or organic disease,



and as defects of vision are easily feigned the examination of the vision in doubtful cases should be made by a medical officer.

The following modifications have been made by order of the Secretary of War and were kindly furnished from the Surgeon General's office by Chas. F. Mason, Major Medical Corps, U. S. Army:

*General Order No. 199.* The following methods for determining and recording acuity of vision and color sense are prescribed for the army and will be followed whenever practicable in the examination of applicants for admission to the United States Military Academy and of applicants for commission, promotion and in any case of disease or disability of officers or enlisted men where these senses may be affected:

In case of applicants for enlistment the existing methods of examination will be continued at the general recruiting station, but the methods herein prescribed will be applied at the recruit depots, depot-posts, and other garrisoned posts.

*Method for Determining and Recording Acuity of Vision.*

The test-type should be placed in a good light, about the height of the eye. If the room is not well lighted by daylight, an artificial light with a reflector should be used, as it will be more uniform.

Place the candidate or patient with back to the window or source of light, at a distance of 20 feet, or 6 meters, from the type.

Examine each eye, covering the other eye with a card or an opaque disc in a trial frame. The hand should not be used for this purpose, as it temporarily blurs vision.

The right eye should ordinarily be examined first before the candidate becomes familiar with the types.

The candidate should be directed to read the test-type from the top of the card down as far as he can see, and his acuity of vision recorded for each eye with the distance of 20 feet as numerator, and the proper distance of the lowest line he can read correctly as the denominator of a fraction.

\*            \*            \*            \*            \*            \*            \*

If the acuity of vision is less than 20/20 and is corrected by glasses, the acuity without glasses and with glasses is given and the correcting formula is noted as:

Vision, R. E. 20/40, corrected to 20/20 by—I. D. cy. 180°.

Vision, L. E. 20/100, corrected to 20/30 by—.50 D. cy. 180°—2.00 D. S.

If he cannot read the type at any distance, the distance at which he can count fingers is recorded as: Vision R. E. can count fingers at 20 inches.



If he cannot count fingers, the distance at which a light can be distinguished is recorded.

If a light cannot be distinguished he is recorded as blind.

As the types are memorized easily, they should not be left where applicants can read them, and it is well in examining the left eye to direct that the lines be read from right to left and to use new type in case of doubt, or to expose one letter at a time by means of a small opening in a card or sheet of paper.

A more correct idea may be obtained by having the candidate read from the top of the card down. Do not direct him to read the lowest line he can see, and always use a card having type from 10 feet to 200 feet.

The distance of 20 feet should not ordinarily be reduced, as a shorter distance leads to some error from the action of the accommodation and from the fact that the type may then be within the far point of moderate myopia.

*Method for Examining and Recording Color Sense.*

Color sense is the power which the retina has of perceiving color, or the sensation from the impression of different wave lengths of light.

Color blindness is the absence of the perception of one or more of the primary colors, red, green and violet.

Complete color blindness is the absence of the perception of all color.

Partial color blindness is the absence of the perception of one or two of the fundamental colors, objects of the missing color sense being seen in shades of gray.

When one of the colors is absent there is said to be complete red, green or violet blindness. Violet blindness is rare, the ordinary forms being red and green blindness.

The following method of Holmgren is used for the detection of color blindness and the tests should be applied to all persons examined for admission to the army and the result recorded.

This consists in the power to select various colors in the form of test wools to match certain test skeins.

\* \* \* \* \*

In recording the results of the examination the terms, "color sense normal," "color sense feeble," "incompletely color blind," "completely red blind," "completely green blind," "completely violet blind" and "completely color blind" (all colors) will be used.

*Circular No. 4. The following minimum visual requirements for recruits* will supersede such requirements of the Epitome of Tripler's Manual as are in conflict therewith:

For the line of the Army and for the Signal Corps: 20/40 for the better eye, and 20/100 for the poorer eye, provided that no organic disease exist in either eye.

Recruits may be accepted for the line of the Army when unable with the better eye to correctly read all of the letters on the 20/40 line, provided that they are able to read some of the letters on the 20/30.

For the Ordnance Department and for the Hospital Corps: 20/70 in each eye, correctible to 20/40 with glasses provided that no organic disease exists in either eye.

**Rules for Visual Examination of the United States Navy.**

The following was kindly furnished by W. C. Braisted, Acting Chief of Bureau, U. S. Navy:

The examination for visual acuteness is of the utmost importance, and shall be conducted by the medical officer with the greatest care and patience. An appreciable percentage of men are the subjects of slight visual defects, and in the cases of many of those presenting themselves for re-enlistment and enlistment these defects may not be sufficiently serious to disqualify them for the naval service. The ignorance, stupidity or fear on the part of an applicant undergoing examination should be taken into consideration by the examining surgeon, and unless the examination is conducted with care and deliberation an applicant may be rejected whose vision is in reality good. Slight errors on the part of the applicant, such as mis-reading a P or T for an F, provided the majority of the letters or test characters are read with facility, need not be regarded as sufficient cause for rejection. The examination shall be conducted in a large, well-lighted apartment, and the test cards shall be placed in a good light. The applicant stands at a distance of 20 feet, one eye being tested at a time, and the other covered by a card. Vision is to be expressed as a fraction, of which the numerator shall be the distance at which Snellen's 20-foot test can be determined, and the denominator 20. Normal vision (20/20) for each eye tested separately, shall be required, but in candidates who are otherwise physically sound a minimum visual acuteness of 15/20 shall suffice. The existence of several minor defects combined with a visual acuteness of 15/20 in each eye, shall cause the rejection of the applicant.

Color perception to be always carefully determined. The usual examination is by Holmgren's method, which may be briefly described as follows: The worsteds are placed in a pile in the center of a piece of white muslin, which is spread out on a flat surface in a good day-

light. The green test skein is placed aside upon the white cloth, and the person to be examined is directed to select the various shades of the same color from the pile, and place them by the sides of the sample. The color-blind will make mistakes in the selection of the shades; or a hesitating manner with a disposition to take the wrong shade may show a feeble chromatic sense. The purple test skein is then used. If the test with the green skein has shown the person examined to be color-blind and on the second or purple test he selects only the purple skeins, he is incompletely color-blind; but if he places with the purple, shades of blue or violet, or both, he is completely red-blind. If, however, he selects to be placed with the purple, shades of green or gray he is completely green-blind. The red test skein need not necessarily be used, but it may be employed to confirm the diagnosis already made, for the red-blind will select to match the red skein shades of green or brown which, to the normal sense, seems darker than the red, while the green-blind will select the shades of green or brown which seem lighter.

*Special Order No. 79.* As it is important that no man be employed as gun pointers, who are materially deficient in eyesight it is directed that all candidates for this position, shall, before being placed in training, be referred by the commanding officer to the medical officer for examination, and that hereafter no man shall be trained as gun pointers who cannot read with the right eye (or the left eye if used in aiming) at 20 feet the line in Snellen's test card, which is normally seen at 15 feet—that is  $20/15$  vision and a minimum of  $20/20$  shall be required with the eye not used in aiming.

This degree of visual acuity in gun pointers is deemed necessary in order to eliminate those men having ocular defects, which would tend to prevent continuous accurate aiming during a considerable period of time.

Before each record target practice all qualified and acting gun pointers shall be examined for acuity of vision and the result entered on the Gunnery Record. A report will also be submitted to the Department.

All examinations in connection with this order shall be carried out with the test card well illuminated.

**Rules for Visual Examination of Pilots, Masters and Mates of the Marine Service.**

These have been kindly furnished by W. Wyman, Surgeon General, Public Health and Marine Hospital Service.

The examinations are made by medical officers of the Public Health and Marine Hospital Service.

The minimum amount of visual capacity required for an applicant for the position of Pilot is not less than  $15/20$  vision in both eyes (not including errors of refraction corrected by glasses).

The visual acuity for pilots, masters and mates is the same.

Any red or green color blindness is sufficient cause for rejection of the candidate.

The Holmgren worsted tests are employed for testing color sense, and the eyesight is tested by the use of the Snellen test-type, each eye being tested separately.

Lantern tests are not used in addition to the Holmgren worsted test.

The following is taken from the General Rules and Regulations prescribed by the Board of Supervising Inspectors, Department of Commerce and Labor, Steamboat Inspection Service:

Officers of the Naval Militia who are applicants for license as master or pilots of steam vessels of the Naval Militia, after passing an examination for color-blindness, may be examined by the inspectors as to their knowledge of the pilot rules and handling of vessels; and if the applicant be found qualified in the judgment of the inspectors, he may be granted a special license as master, mate or pilot on such vessels on the waters of the district in which such license is granted and for no other purpose.

No original license as master, mate or pilot of any vessel propelled in whole or in part by steam, gas, fluid, naphtha, also vapor, electric or other light motors, or master or mate of said vessels, shall be granted except on the official certificate of a surgeon of the Public Health and Marine Hospital Service that the applicant is free from the defect known as color blindness. No renewal of license shall be granted to any officer of the classes named who has not been previously examined and passed for color blindness.

Any person requiring examination for color blindness who is living at a distance of 100 miles or more from a surgeon of the Public Health and Marine Hospital Service may be examined for color blindness by any reputable physician; and the physician shall furnish a duplicate report of the examination made upon the regulation blanks, one copy of which shall be furnished the applicant and the other sent to the local inspectors of steam vessels to whom the applicant shall apply for such original or renewal of license.

**Rules for Visual Examination of the Employees of the Milwaukee Electric Railway and Light Company.**

(Kindly furnished by Dr. Chas. H. Lemon, Chief Surgeon.)

1. Motormen must have 20-20 vision in each eye—no exception

made to this rule. They are re-examined when they go on the Interurban service and the same requirements are observed, 20-20 Vision.

2. Conductors must have 20-20 in one eye and not less than 20-30 in the other eye. When they are re-examined for the Interurban service 20-30 in each eye is accepted.

3. The eye test is made by a trans-illuminated chart, furnished by F. A. Hardy & Co., the illumination of the chart being designed by the Holophane Company.

4. No re-examination of motormen and conductors is made unless specific complaint is made.

5. For the color test, a card having various colored yarns upon it is used and the men are required to name the colors. If they name these colors without hesitation they are passed, if they hesitate they are given the usual Holmgren test.

6. Men are not accepted who wear glasses for the correction of any visual defect. If they need glasses after serving a few years they are permitted to wear them. Experience of twelve years has demonstrated that the men themselves are more satisfied with the results obtained by the trans-illuminated chart than they were formerly with the card board chart which grew yellow with age and had a light thrown upon it.

# CHAPTER XIII.

## THE TREATMENT OF CERTAIN SYSTEMIC DISEASES THAT INVOLVE THE OCULAR APPARATUS.

BY ALFRED C. CROFTAN, M. D., CHICAGO, ILL.

*Toxemias—Autointoxications—Stagnation of the Gastro-intestinal Contents—Perversion of the Gastro-intestinal Secretions—Putrefactive Bacteria in the Stomach and Intestines—Constipation—Autointoxication in Hepatic Disorders—Autointoxication in Metabolic Disorders—Diabetes Mellitus—Treatment of the Above Toxemias.*

The successful treatment of many ocular disorders is in the main dependent upon the discovery of some remote underlying cause and its proper correction. The factors that directly determine the involvement of the ocular apparatus in systemic disorders are, broadly speaking, twofold, viz.: *toxic* and *circulatory*, the two being closely correlated. For the circulation of toxic bodies, immaterial what their source and character, as a rule produces vaso-motor disturbances, vessel-contraction or-dilatation, with resulting nutritional changes in important organs, and especially in organs supplied by end-arteries, chief among them the eyes. Circulatory, *i. e.*, cardio-vascular changes, on the other hand, of a primary character (valvular disease, arterio-sclerosis, cardio-renal disease), of necessity produce quite similar blood-vessel changes, especially again in end-organs. At the same time, by deranging the blood supply to organs concerned with assimilation and intermediary metabolism, circulatory disorders favor the derangement of these latter functions, thereby causing the flooding of the blood and tissue-juices with imperfectly or improperly elaborated, usually toxic, products of intermediary metabolism. Thus a vicious circle is not infrequently closed; the toxemia causing circulatory disturbances; the cardio-vascular derangement causing a toxemia.

Looking at the treatment of the ocular complications of systemic disorders from this standpoint, the classification and grouping of the numerous diseases that have to be considered becomes relatively simple. To the category of toxemias belong beyond doubt all the metabolic disorders, as diabetes, gout, rheumatism and rheumatoid conditions, rickets, as well as the protean array of rather undefined general symptom-complexes, attributable to digestive disorders. To this same category belong the acute infectious diseases, notably diphtheria, malaria, small-pox, syphilis, gonorrhea, tuberculosis and others that are

known to produce ocular disorders largely by toxic, partly by direct bacterial, influence. On the borderland between the toxemic and the circulatory group lie such diseases as exophthalmic goitre, the blood diseases proper, viz. chlorosis, leukemia, pernicious anemia and secondary anemia, as well as the various manifestations of the hemorrhagic diathesis; also Bright's disease (cardio-renal disease), while finally, the diseases of the heart and the arteries proper comprise the group of circulatory affections that can directly produce eye-lesions.

Within the narrow frame of this chapter it will of course be impossible to discuss more than the general principles that should underlie the treatment of these various diseases. For all the finer details I refer to my book on "*Clinical Therapeutics*," from which I have extensively quoted in this article.

### TOXEMIAS.

The character, the composition of the numerous poisons that must be incriminated with producing some of the ocular disorders to be presently specified remain for the present unknown or at least undefined; hence no *specific* (with the exception of a few of the bacterial toxemias), antitoxic treatment can, in the obscurity of our present-day knowledge, be instituted. The source, on the other hand, and the manifestations of these toxins are very well understood, hence a large and successful field remains for *causal* and *symptomatic* therapy.

The toxins may either be generated within the body (endogenous toxemia) or they may be introduced from without (exogenous toxemia). In the former case we speak of *auto-intoxication* and include under this name a group of symptom-complexes attributable in the main to a variety of gastro-intestinal, hepatic and metabolic, *scil-con-*stitutional, disorders. The exogenous toxemias include all forms of poisoning due to unorganized bodies (alcohol, tobacco and other alkaloids, metallic poisons, etc.) introduced from without and also intoxication by poisons elaborated within the body by parasites (bacteria, tænia, amoeba, etc.)

The causal and symptomatic treatment of each of these groups and of some of the diseases comprising them must now be discussed separately.

### AUTOINTOXICATIONS.

#### Auto-Intoxications of Gastro-Intestinal Origin.

Three factors principally determine auto-intoxications of gastrointestinal origin, viz.:

1. Stagnation of the contents of the stomach and bowel.
2. Perversion, qualitative or quantitative, of the gastro-intestinal secretions.



3. Invasion of the gastro-intestinal tract by abnormal putrefactive bacteria or the unchecked overgrowth of normal species of the intestinal flora.

As a rule several of these factors are combined and the existence of the one directly or indirectly determines the incidence of the others.

The correction of these important defects must proceed according to the following principles:

**Auto-Intoxication from Stagnation of the Gastro-Intestinal Contents.**

This is due to inability on the part of the gastro-intestinal wall to propel the contents of the digestive canal onward within the normal time. This inability may be due to atony of the gastric or intestinal musculature or to mechanical causes as, e. g., narrowing of the intestinal lumen, malposition or sacculation of parts of the tract, or to both these factors combined.

In the case of the stomach we witness the appearance of motor insufficiency, gastric ectasy, gastric atony; in the case of the intestine of intestinal stenosis of various kinds and, broadly speaking, of chronic constipation.

An immense amount of thought, ingenuity and labor have been expended in devising methods for determining the exact condition of the gastric walls—for recognizing and differentiating ectasy and atony and simple dilatation and megalogastria. However valuable and interesting such refinements in diagnosis may be, they furnish little information in regard to the proper treatment of all these conditions (popularly known as *dyspepsia*, *indigestion*, *biliousness*) that may not be briefly expressed in the following sentences:

The three main indications for treatment are (1) to improve the motor power of the stomach, (2) to prevent further dilatation, (3) to adequately nourish the patient despite his stomach trouble in order to maintain the best possible general nutrition.

The diet, then, should be of such a character that it imposes the minimum of labor on the stomach walls, that it contains none of the articles that can readily undergo acid or gaseous fermentation when they stagnate in the stomach. The state of the gastric secretion must at the same time be carefully taken into consideration, so that the composition of the food must also vary according to the presence or absence of sufficient or over-abundant hydrochloric acid and peptic ferments.

If the secretion of hydrochloric acid is normal or increased, there is no objection to the use of meats or other albuminous foods, inasmuch as these are properly digested in the stomach; at the same time, especially in the presence of hyperchlorhydria, the ingestion of amylaceous foods should be reduced; for the digestion of the latter is al-

ways impeded in the presence of much hydrochloric acid in the sense that amylolysis is interfered with and they undergo abnormal decomposition when they remain in the stomach in an undigested state for an abnormally long time.

If on the other hand the secretion of gastric juice is reduced, no meats at all should be given, but only eggs, milk and mushy amylaceous foods, *i. e.*, gruels, made of milk with wheat flour, rice, barley, tapioca or sago, milk-toast, vegetable purées, fruit, butter, cream and olive oil and breadstuffs.

Large meals should always be avoided and all the above articles should be given in small quantities at frequent intervals. From a practical standpoint it is best to experiment a little in each case, *i. e.* to determine at frequent intervals by actual removal of the stomach contents after a mixed meal which foods of the different kinds are retained and which evacuated within the normal time limits. In combination with such a motility test a study of the gastric secretion can be advantageously made and the selection of the diet regulated accordingly.

All articles of food that are coarse in texture, that contain indigestible parts like tendons, skin, connective tissue in the case of meats, stems, husks, pips, seeds in the case of vegetables, should be forbidden. Carbonated beverages that distend the stomach; alcoholic liquors of all kinds, solutions of albumoses and peptones, very salt and very sweet foods are all forbidden because they all draw water into the stomach and hence overburden the organ.

For the same reason the total liquid intake should be reduced. Too dry a diet should, however, be avoided as the propulsion of semiliquid and mushy foods is easier in motor insufficiency than the propulsion of a "dry" stomach contents. Too great a liquid restriction as advised by some may even lead to dehydration of the tissues and in extreme cases to tetany.

Sometimes rectal administration of liquids is of aid to supply enough fluid; this measure in combination with complete food abstinence for a period of days, with or without rectal feeding, is in severe cases often of signal value. Rest after meals is always indicated; and these patients should be told to lie down for half an hour after each feeding, preferably on the right side, as this facilitates the movement of the food through the pylorus. The evening meal should never be eaten too near bed-time as digestion is less active during sleep and stagnation is favored in this way.

Lavage of the stomach is probably the most valuable remedy we possess, provided it is carried out persistently. By removing undigested residue from the stomach after the time for its physiological

removal is passed, stagnation is effectviely prevented; moreover the digestion of the next meal is not disarranged by the presence of foul, decomposing material in the stomach; hence nutrition is not so seriously interfered with if lavage is performed than if it is omitted. In advanced cases the following plan is the best: Several hours before retiring, *i. e.*, late in the afternoon, the stomach should be washed out; in this way any residue that may have remained behind from breakfast or luncheon is removed and the evening meal is introduced into a clean stomach. The latter should be digestible within three hours and should be composed of material that can undergo such rapid digestion. In case food particles, nevertheless, are still found in the stomach in the morning, then morning lavage must be instituted; or if the patient suffers much distress during the night, then washing of the stomach before retiring may become necessary besides. In general a daily lavage late in the afternoon is all that is required. The technique of lavage need not be described in this place. The addition of various drugs to the wash waters as, *e.g.*, boric acid, resorcin, salicylic acid, hydrochloric acid or bicarbonate of soda as the exigencies of the case may demand, needs only be mentioned; their main sphere of usefulness is to prevent fermentation and to stimulate the gastric walls to increased activity—and it is highly problematical whether they really accomplish this and whether plain water is not equally effective. Douching and spraying the stomach walls with water or with medicated solutions is of subordinate value as compared to lavage. Electricity applied in various ways, in my experience, is of no value whatsoever. Properly performed massage, and certain simple hydrotherapeutic measures are often highly efficient.

Drugs have only a very subordinate place in the treatment of motor insufficiency; we are dealing here largely with a mechanical difficulty and hence the most effective means are mechanical in character; hence surgery, too, may occasionally be useful, especially, of course, in pyloric occlusions producing stagnation of the stomach contents; here and there drainage of the stomach by gastro-enterostomy, mechanical reduction of the size of the stomach, correction of malpositions of the organ may be indicated.

#### **Auto-Intoxication from Perversion of the Gastro-Intestinal Secretions.**

This becomes manifest either as gastric hypersecretion or as hyposecretion; it is probable that quite similar conditions exist in the case of the bowel, although the clinical type in the case of the intestine is not clearly defined and impossible to definitely identify in any case. One can assume *a priori*, however, that measures directed against the

perversion of gastric secretion will be equally effective in the treatment of the like intestinal perversion; hence a discussion of the former disorder will cover the whole ground as well as it can be covered, and sufficiently, at all events, for the practical purposes of this article.

*Gastric hypersecretion* is always accompanied by hyperchlorhydria, but the latter condition may occur as an independent affection and manifest itself by an excessive outpouring of hydrochloric acid only when the stomach contains food. The two differ in degree more than in kind; hypersecretion being a continuous form of hyperchlorhydria occurring without the stimulus of food; hyperchlorhydria a periodic hypersecretion requiring the food stimulus to be produced. Both conditions frequently accompany neurotic states, hence the causal treatment in any case, even if other direct determining causes (diet indiscretions, abuse of alcohol, tobacco, organic lesions in or about the stomach) are discovered, should take any neurasthenic or hysterical tendencies carefully into consideration; and the latter neurosis defects should by all means be treated *secundum artem*.

Inasmuch as the outpouring of excessive gastric juice with an abnormal amount of hydrochloric acid is in most cases due to the stimulating effect of certain articles of food the selection of the proper diet is of the greatest importance. The diet while adequately nourishing the patient should be mechanically non-irritating *i. e.* it should contain no coarse or indigestible particles (see above). It should contain no spices or condiments (mustard, pepper, paprica, cloves, etc.) nor any fruits or vegetables incorporating irritating oils (onions, radishes, horse-radish, etc.) nor should very hot foods, very acid foods nor strong alcoholic beverages be allowed.

The diet, however, should contain abundant albuminous pabulum; for the latter owing to its power to combine with hydrochloric acid acts as an antacid and thereby gives symptomatic relief. The preparation of meats is important, for all cured, spiced or corned meats on account of the spices, salts and extractives they contain, directly stimulate the flow of gastric juice and should hence be avoided. The selection of meats should also be governed somewhat by the presence or absence of motor insufficiency. If the stomach does not get rid of its stomach contents within the normal time (and this is rarely the case in hyperchlorhydria) then all coarse varieties of meat, or other food, should be avoided; if on the other hand there is no motor insufficiency, or on the contrary increased power on the part of the stomach to propel the food onward through the pylorus, then coarser meats are particularly useful as they require much hydrochloric acid for their digestion and hence possess relatively large hydrochloric acid binding powers. Starchy foods are digested with difficulty in hyperchlor-

hydria, the hydrochloric acid inhibiting the action of the swallowed saliva and in this way seriously interfering with amylolytic digestion: unless rapidly propelled onward this category of foods, therefore, undergoes abnormal fermentation in the stomach leading to the formation of gases and irritating organic acids. This effect can in part be counteracted by the administration of dextrinized, *i. e.*, partly digested carbohydrate foods, as for instance, toasted or malted foods, or even dextrose itself (the end product of amylolysis) in ten to twenty per cent. watery solution. Fats may be given with impunity in hyperchlorhydria, preferably as butter, cream, vegetable oils; animal, *i. e.*, meat fats being far less digestible in this condition. Abundant intake of fluids, provided there is no gastric atony, should be encouraged. Carbonated, alkaline waters are particularly useful as they combine antacid powers with slightly anesthetic properties ( $\text{CO}_2$ ) and are consequently particularly useful when hyperchlorhydria is associated, as it commonly is, with gastric hyperesthesia. Alcoholic liquors, tea, coffee, as well as smoking, are best forbidden, because all these indulgences decidedly stimulate the flow of gastric juice.

Small meals at frequent intervals, containing abundant albuminous pabulum (see above) are better than large meals at longer intervals. It is a good rule on the one hand never to overload the stomach, on the other never to allow the stomach to become quite empty. For this reason an egg or a glass of milk with a piece of zwieback given in the middle of the forenoon, the middle of the afternoon and before going to bed, if need be, again in the middle of the night in case of nocturnal distress, are very useful.

Lavage is of little value unless there is motor insufficiency. Douching after a cleansing lavage with a 1-1,000 silver nitrate solution, or a two per cent. boric acid solution, is often of value. The silver nitrate seems to act as an anesthetic and anti-fermentative and occasionally even seems to reduce the hyperchlorhydria.

Of drugs that can reduce the secretion of hydrochloric acid belladonna, preferably given in combination with an alkali, as burnt magnesia or sodium bicarbonate, is the most efficient. The active principle of belladonna, atropine, is equally useful and is best given hypodermically in the dose of one one-hundredth to one-fiftieth of a grain, once a day, in the morning. The various alkalies have a useful place as antacids; the most commonly employed are sodium bicarbonate, magnesia usta and magnesium carbonate. The latter salts are slightly less irritating to the gastric mucosa, do not develop carbonic acid gas so rapidly when brought in contact with hydrochloric acid, bind nearly four times as much acid bulk for bulk as sodium bicarbon-

ate and possess certain desirable laxative properties that render them preferable to sodium bicarbonate. Carbonated alkaline waters and saline waters are also very valuable in the treatment of hyperchlorhydria. It is debatable, however, whether the good results seen from their use when taken in certain watering places are attributable to the ingredients of these waters so much as to the pleasant life at the Spas and the respite from worry, fatigue, etc., not to speak of the strong suggestive effect, that existence in such resorts offers.

In *gastric hyposecretion and achylia gastrica, i. e.,* in complete suppression of the gastric secretions, we may again be dealing with a neurosis, although this disorder is more commonly witnessed in organic diseases of the stomach. When the reduction or absence of hydrochloric acid is therefore established, cancer, chronic gastritis, gastric atrophy, amyloid disease, etc., should be carefully sought for and treatment instituted accordingly.

The selection of the diet in these cases is largely dependent upon the existence or non-existence of motor insufficiency; if the motor power is good, then every effort should be put forward to maintain it by the avoidance of coarse and indigestible foods, by moderate ingestion of liquids, by small meals. Meats may be allowed, but they should be prepared in a very digestible form.

If the motor power is impaired, meats are best avoided altogether, for under these conditions the intestine cannot vicariously assume the digestion of the albumens and auto-intoxication is very apt to supervene. Here, then, even albuminous foods other than meats, as eggs, milk and vegetables rich in albumens should be given sparingly. Occasionally the administration of pancreas together with an alkali is of use, for this therapy enables tryptic (*i. e.,* intestinal) digestion of the albumens to begin in the stomach. Inasmuch as the digestion of starchy or sweet foods is in no way impaired in hypochylia and achylia gastrica they should constitute the major portion of the diet. Fats in any form are allowed but only in moderate quantities for two reasons, viz.: first, because fats readily produce a sense of satiety, in other words promptly spoil the appetite, second, because they readily undergo decomposition with the production of highly irritating products in themselves are poisonous if absorbed.\*

Small quantities of alcoholic beverages, spiced foods, salted foods, meat extracts are very useful because they slightly irritate the gastric walls and hence stimulate the flow of gastric juice. The use of drugs to accomplish the same purpose is theoretically indicated, but practically of problematic utility. Hydrochloric acid with a little gentian, nux

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\*For tables of digestibility see "*Clinical Therapeutics*," p. 349.



vomica, condurango, cinchona or quassia given before each meal is of some value. The administration of large quantities of hydrochloric acid given with the object of replacing the deficient gastric acid is of doubtful use; for if the motor power of the stomach is good this procedure is superfluous because the intestine will, anyhow, vicariously assume peptic digestion; in fact, under these conditions the administration of large quantities of acid may be decidedly detrimental because it reduces the alkalinity of the intestinal contents. If, on the other hand, the motor power is impaired, then lavage and other measures discussed above are far more effective. The administration of pepsin is rarely indicated for similar reasons; what is usually deficient is the acid, not the enzymes; if the motor power is good they are not needed, if it is impaired the diet should be regulated in such a way that minimal requirements are made upon the peptic power of the stomach.

#### **Auto-intoxication from Putrefactive Bacteria in the Stomach and Intestines.**

This is a very common condition and is usually associated with *chronic constipation*. The treatment of this toxemia, therefore, must concern itself both with an attempt to promote intestinal antiseptics and with means intended to cure the constipation; for if the bowel contents is propelled onward in the proper time or more rapidly than normal (as in toxic diarrheas) then really very little time is given for the absorption of intestinal poisons and the chronic toxemia under discussion cannot take place.

There are several types of constipation and each requires special treatment. In so-called alimentary constipation the arrangement of a "laxative" diet usually suffices to correct the defect. Such patients should receive abundant vegetable, fat and carbohydrate material and relatively little albuminous food. For meat, eggs and milk leave only a very small residue in the bowel because they are so thoroughly dissimilated; they also contain only a small proportion of indigestible material; moreover, none of the end products of albuminous digestion stimulate intestinal peristalsis. Vegetables and fruits, on the other hand, incorporate abundant indigestible residue, hence leave a large and bulky stool that mechanically stimulates the bowel wall to peristalsis; besides, many organic acids, as well as carbonic acid gas, are formed that increase the bowel movements and render the stools soft and fluffy, hence easy to be propelled onward. The sugar contained in starchy foods, or formed from them in the bowel, being hygroscopic, prevents the absorption of too much water from the bowel and keeps the bowel contents thoroughly moist. Fats, finally, lubricate the walls of the intestine and, besides, favor the formation of glycerin, soaps



and fatty acids that all possess laxative and peristalsis-stimulating properties.

In some forms of constipation this diet does not produce the desired effect. If the constipation is due to mechanical causes as stenosis, knuckling, compression or constriction of the bowel, it may rather do harm than good; the same applies to cases of venous engorgement of the bowel wall in heart disease and in portal stasis, for here a bulky diet is dangerous; the same also applies to chronic constipation occurring in the course of chronic gastric cararrh. In all these cases a careful diagnosis must be made and the patient treated accordingly. The routine use of laxatives is especially to be condemned in this variety of the disorder.

There is, too, a spastic form of constipation occurring in the course of certain organic nervous disorders and in neurotic subjects as well as in certain forms of metallic poisoning; here appropriate causal treatment is, of course, indicated and the above diet is thoroughly unsuited. Symptomatically, the best results are obtained from the use of opium and belladonna, as both drugs reduce the sensibility of the bowel mucosa and reduce reflex spasms of the intestinal muscularis. Here laxatives are directly harmful.

The most common forms of the disorder is the atonic variety of habitual constipation, characterized by weakness of the bowel musculature. Here the fat-vegetarial diet is useful again; it should not be given persistently; for the bowel may in the beginning react by increased peristalsis to the stimulus of a bulky and slightly irritating diet, only within a short time to lose its power to react in this way, If under these conditions a bulky diet continues to be administered it will stagnate and putrefy and the condition precisely be favored that it was intended to counteract. In such cases the evacuation of the bowel contents must in the beginning be promoted by other than dietetic means.

First and foremost comes "education"; the patient should be taught to attempt a movement of the bowels at regular stated intervals during the day: in this way the normal automatism of defecation may often be restored. Massage of the abdomen, if properly carried out and if persisted in is of use. Many hydrotherapeutic measures, the details of which cannot be discussed here, are of signal value, especially cold and hot Sitz baths, abdominal douches and sprays, Priesnitz compresses. Electricity is of very subordinate value as the currents pass along the abdominal muscles and probably do not affect the intestinal musculature at all. Irrigation of the rectum is a useful mechanical means; if the water is used cool, general intestinal peristalsis is stimulated; the best application being cold normal salt solution in-

jected into the colon through a high rectal tube. The addition of Glauber salts in the strength of two tablespoonfuls to the pint; soap, vinegar, castor oil beaten up with white of egg all increase the efficacy of these enemata. Glycerine in suppository or in water in the strength of about two tablespoons to the quart; or, finally, olive oil, 2-500 c.c. injected high up, are all useful.

After all dietetic and mechanical means have been conscientiously tried, it may occasionally become necessary to resort to certain laxative drugs; one must experiment a little in each individual; the haphazard and indiscriminate administration of laxatives far from curing the constipation usually aggravates the condition and makes the patient a slave to this class of drug. The smallest possible dose to produce the desired effect is the proper dose. The names of laxatives is legion and each cannot be discussed here. Most useful in my hands have been phenolphthalein, cascara, sulphur, occasionally a little calomel, here and there a saline cathartic, or for more continued use, especially in cases of chronic gastritis or hepatic involvement, an alkaline saline water.

The prevention or correction of intestinal putrefaction is not an easy task. Sterilization of the human intestine with its thirty feet, more or less, of warm, moist culture medium is manifestly impossible; nor is it desirable, for many of the organisms that normally abound in the bowel aid the enteric ferments in the disassimilation of the food and produce certain physical changes in the bowel contents that favor the act of defecation. The human intestine is practically sterile at birth; later, bacteria appear in the bowel contents, some of them pathogenic; against the latter the human organism normally protects itself by very efficient means; when these measures become inadequate artificial intestinal antisepsis is called for.

The principal remedies used as intestinal antiseptics are certain metallic salts, the bile acids and certain organic peroxides. Of the former group one of the most efficient and at the same time least irritating is the sulphocarbolate of zinc, and it is preferable to salts of mercury, lead, copper that are all used for this purpose. The bile acids administered in the form of their sodium salts are useful both because they stimulate an increased flow of bile, that in itself possesses germicidal properties, and because they stimulate the hepatic cells rendering them more active in their function of arresting and disintoxicating any toxic material that may filter through them from the portal circulation, *scil.* from the bowel. The regulation of the dose of the different intestinal antiseptics is of course of the greatest importance and the following method may be employed to determine

whether or not enough is being given to accomplish the desired effect, viz, to hold intestinal putrefaction in check.

Intestinal putrefaction may be considered checked when certain bodies that we know to be formed from the putrefactive disassimilation of the albumens disappear from the stools and the urine, abnormal degradation products of the carbohydrates and fats playing only a very subordinate rôle in the production of intestinal auto-intoxication. Chief among these products are a variety of aromatic sulphur compounds and complex group of substances (glycuronates and glycocolls) also containing aromatic radicles.\*

For clinical purposes it is sufficient to study the sulphids of the feces and the aromatic sulphates—with indican as their prototype—of the urine; and the various intestinal antiseptics should be given in sufficient quantity and long enough to cause the disappearance from the urine and feces of these bodies. The tests for indican need not be given in this article; the disappearance of the fecal sulphids can readily be determined by the following simple method. If together with the remedy about twenty grains of bismuth subnitrate are given, then the disappearance of the characteristic black bismuth sulphid color seen in stools when intestinal putrefaction is going on is an index that enough of the intestinal antiseptic is being administered. Simultaneously with the passage of brown rather than black stools even though bismuth is being exhibited, the indicanuria will also generally be found to stop.

#### **Auto-intoxication in Hepatic Disorders.**

Closely related to intestinal toxemias are hepatic toxemias; for the liver, as indicated above, is the great disintoxicating organ intended to arrest and disintoxicate any poisonous bodies that may be carried to it from the bowel in the portal vein or from any other part of the body in the hepatic artery. The metabolism in the liver is exceedingly active and complex and may become deranged in many different directions leading to the formation of incompletely or wrongly elaborated products of intermediary metabolism, many of which are highly toxic. I refer in particular to the flooding of the blood stream with ammonia radicles that fail of proper conversion into non-toxic urea; to the entrance into the circulation of alloxuric bases (purin, xanthin bases) that should properly have been elaborated into non-toxic (!) uric acid; to the pollution of the circulation with various acid bodies that by reducing the alkalinity of the blood lead to the syndrome of acidemia; finally to the mechanical diapedesis

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\*See Croftan "*Clinical Urinology*," Chapter VII.

of toxic excrementitious bile ingredients that should properly have been poured into the intestine but that, entering the blood stream, produce the well known symptom-complex known as cholemia.

The treatment of this interesting group of hepatic toxemias is largely dietetic and should be directed towards correcting the condition of hepatic insufficiency that, broadly speaking, underlies these morbid conditions.

Three factors chiefly determine functional insufficiency of the liver cells, viz.:—infection, intoxication, mechanical causes. The latter, unless we are dealing with some lesion that mechanically compresses the common duct and that can be removed surgically, is not amenable to treatment, so that in this instance one is limited to purely symptomatic means. There are two exceptions to this rule, viz.:—mechanical lesions due to syphilis, for here antiluetic treatment may lead to the goal; and mechanical scil. congestive lesions due to heart disease in which the defect may be corrected by appropriate cardio-tonic medication.

In the case of the intoxicating factors the source of the poisons in the overwhelming majority of the cases is the gastro-intestinal tract. Here causal treatment should be carried out according to the following principles: To regulate the diet in such a way as to limit the ingestion of substances that are in themselves poisonous or that undergo changes in the bowel that lead to the formation of poisonous bodies; to reduce to the lowest possible minimum intestinal putrefaction; to prevent as far as possible the absorption of whatever poisonous bodies may have gained an entrance to the bowel or may have been formed there; to promote the destruction of the latter in case they enter the circulation and, above all, to hasten the rapid elimination of circulating toxins. The latter indication prevails with equal force in the case of poisons that are not formed in the bowel but that are generated within the tissues of the body (endogenous poisons) as in infectious diseases and in a variety of metabolic disorders.

Probably the most important dietetic rule in the treatment of hepatic insufficiency is a negative one, viz.: that all alcoholic beverages should be rigidly excluded. The alcohol itself is not so dangerous as the numerous ethereal oils, aldehydes, etc., that are contained in cordials, liqueurs, and other alcoholic drinks. On the same grounds spices and condiments of all kinds should be avoided. The ingestion of fats should be limited, for they are poorly digested in hepatic insufficiency on account of the deficit of bile acids in the intestine: under these conditions they are not properly emulsified and saponified and consequently lead to the formation of several highly acrid and acid

decomposition products that are very irritating to the liver. It has been shown that in cases of hepatic insufficiency the toxicity of the urine increases greatly on a fat diet. Meat and eggs should also be eaten sparingly, for they furnish the bulk of the most poisonous intestinal products that arise from putrefactive processes; whenever the bile flow is reduced as in the condition under discussion these putrefactive processes are particularly active.

There remain, therefore, as the chief articles of diet, vegetables and carbohydrates; the latter in particular are not toxic nor do they lead to the formation of toxic products in the bowel; and, besides, sugars, as we know, stimulate the liver cells to activity. Of course, care should be exercised not to feed carbohydrates too abundantly as otherwise fermentative dyspepsia, constipation and a variety of digestive disorders may supervene. One should simply increase the amount of carbohydrate food to replace the fat deficit. Milk can always be given in these cases and buttermilk is an excellent food. To summarize, the patient should be placed upon a bland mixed diet containing no alcoholic beverages, a minimum of fat, a small amount of animal albumens and plenty of fresh fruits, vegetables, milk, cereals, starches and, with care, sweets.

The use of intestinal antiseptics (see above) is of course thoroughly indicated in this disorder; and it is clear that the absorption of bowel poisons that may have been formed can be greatly reduced by the liberal use of evacuants. A saline laxative, therefore, given at frequent intervals combined to advantage with rectal injections is of signal value; while the use of strong and drastic purges is to be condemned as detrimental to the liver.

As in the treatment of any other function that has become insufficient gentle stimulation, preferably preceded by a period of rest, should be bestowed upon the liver cells. The measures discussed above constitute a sparing of the liver function, a rest. Stimulation, with the object in view of restoring normal tone can be carried out by increasing the demands upon the liver cells either by dietetic-physical or medicinal means. The diet rules have already been discussed in outline. The most efficient physical means are hydrotherapeutic, *i. e.*, such simple procedures as cold douches to the liver region, a general hot bath, Priesnitz compresses to the hepatic area, all means that can stimulate the bile flow. Many remedies are said to stimulate the formation of bile. Unfortunately most so-called cholagogues do not possess this power at all, but simply irritate the stomach, the intestine and the liver. Best of all are salicylic acid preparations and the bile acids. Preference should be given to the latter as the salicylates

irritate the kidneys and the function of these organs, that vicariously assume the disintoxicating function of the liver when the latter organ is diseased, should above all things be protected. The bile acids, moreover, are also useful as intestinal antiseptics (see above) and hence serve a doubly valuable purpose. The stimulation of the important glycogenic function of the liver can be brought about by an active alkali therapy, *i. e.*, the liberal use of soda bicarbonate, magnesium oxid, calcium carbonate, either in powder form or in the form of mineral waters containing these ingredients. Some good results may accrue occasionally from organo-therapy, *i. e.*, the use of liver extracts, but this form of treatment is still somewhat problematical although founded on some very suggestive experimental work.

#### **Auto-intoxication in Metabolic Disorders.**

Among the diseases of metabolism are included diabetes, obesity, gout and the uric acid diathesis, osteomalacia, rachitis, and in a special sense, chronic rheumatism. In many other diseases perversions of metabolism occur, but there the metabolic derangement is merely one more or less unimportant and, at all events, secondary symptom of a definite and known underlying cause. In the diseases of metabolism proper the metabolic derangement is the primary event and the determining factor in the production of the disease. All the diseases of this group, especially diabetes, obesity and the uric diathesis are intimately related to one another pathogenetically, chemically and clinically, so that much that can be said in regard to the treatment of one member of the group often applies with equal force to the treatment of the others. Causal treatment, however, in view of our ignorance, for the present, of the etiology of the diseases of metabolism, and also in view of the intangible hereditary element that is so important a factor in all functional weakness or perversion of protoplasmic function, is not satisfactory; the main therapeutic indication is, therefore, by dietetic means to compensate the defective intracellular nutrition and at the same time to maintain adequate general nutrition. This can only be done by applying accurate, almost mathematical, measures. The latter unfortunately cannot be described in the narrow frame of this article and I will content myself, therefore, with outlining briefly the practical application of these methods that has been evolved from many accurate and scientific metabolic studies in persons suffering from metabolic disorders.

#### **Diabetes Mellitus.**

The main object to be accomplished is to maintain the general nutrition of the patient, to increase the tolerance for carbohydrates and by implication to prevent or reduce the loss of sugar in the urine. It



must be understood that in a case of diabetes with the loss of valuable unconsumed sugar in the urine a diet that would adequately feed a normal individual does not furnish the body with sufficient caloric value and as a result the patient, once the deficit is not supplied, consumes his own tissues and emaciates. Here, therefore, whenever possible a metabolic study\* should be undertaken to determine this deficit. Such a study is of inestimable value provided the figures obtained are interpreted with due conservatism. If it were true that a diabetic could utilize none of the sugar that enters the blood stream the question of feeding such a case would be theoretically very simple. All one would have to do would be to exclude the carbohydrates from the diet and replace them by fats and albumens of sufficient caloric value to make up the deficit. As a matter of fact, however, only a small minority of the cases of diabetes are altogether unable to utilize any of the sugar; these are the very grave instances that, fortunately, are rare and would be still less frequent if many milder cases were not transformed into severe ones by injudicious feeding. The great majority of the cases can utilize some sugar and it is generally bad practice to withhold this food permanently as a routine measure; for aside from the glycosuria the comfort of the patient, his digestive function and above all the formation of the acetone bodies must be carefully considered in arranging a dietary.

In order to know how much sugar these patients can tolerate the boundary of tolerance must be established; this is a simple matter. The patient is given a diabetic "test meal" containing a series of articles that are free from carbohydrates, and when the urine has become sugar-free, increasing quantities of bread or of some other starchy food. The point at which sugar reappears is determined and this is the boundary of assimilation or of tolerance. The patient not only may, but should, receive a certain amount of carbohydrate corresponding to this amount of bread; a boundary of tolerance determination should then be made at frequent intervals for a time and the dietary changed accordingly. For diabetic test meals, tables of caloric values of the different food stuffs, equivalents in starchy foods and the establishment of the different types of diabetes, I refer to my book on "*Clinical Therapeutics*," pp, 113-157.

Three types of diabetes can conveniently be established, viz.: the light, the medium and the severe type. In the first type the urine is easily rendered sugar free if carbohydrates are withheld for 48 hours; these cases can even tolerate the addition of considerable quantities of white bread or of its equivalent to the diet without passing sugar. In

\*For an outline of such a study and the principles underlying it see Croftan, "*Clinical Therapeutics*," 2d Ed., pp. 119-120.

the medium cases it takes fully two weeks to render the urine sugar free on a strict diet, and the boundary of tolerance after this has been accomplished is very low, often zero. The severe type finally cannot be rendered sugar free even after months of restricted carbohydrate-free diet; here and there the reduction of the albumens, together with the complete withdrawal of carbohydrates, causes the sugar to disappear from the urine, but such feeding, of course, constitutes practical starvation and cannot be borne indefinitely. It is far better in the last deplorable class to allow glycosuria to persist and to devote all efforts towards maintaining weight and general nutrition and towards preventing the dreaded formation of the acetone bodies and the general acid toxemia that their appearance so often ushers in. For an acid toxemia often inaugurates and not infrequently determines the incidence of the most dreaded complication of diabetes, viz., diabetic coma.

It is a fact that is not sufficiently recognized that the complete withdrawal of carbohydrates leads, even in a normal subject, to the formation of these acetone bodies (oxybutyric acid, diacetic acid, acetone) and that giving even a little starchy food to a subject that has been living on a restricted "orthodox" diabetic diet may cause their disappearance. This physiological fact, the explanation of which need not be entered upon in this place, should never be lost sight of; neglect to observe it is often responsible for particularly distressing forms of acidemia with all that that entails. The finer technique of feeding diabetics is exceedingly difficult; the co-operation of the patient is not easily enlisted when it is a question of bringing sacrifices to the demands of a usually voracious appetite; much patience and a great deal of skill on the part of the physician are required and the patient must be kept under careful control for long periods of time. But all these sacrifices are well worth while and lives are often saved by a little firmness, thoroughness and patience. It is altogether deplorable to see the slovenly routine that is so commonly adopted of handing every patient who presents himself with sugar in the urine a diet list on which are printed the articles of food that contain carbohydrate. This method of "treatment" is unfair to the patient and casts reflections upon the honesty of the physician's endeavor to help.

Medicines are of little avail in diabetes. In cases in which leucic origin is suspected iodides and mercury are of course indicated. Arsenic is of no value whatsoever. Opiates can reduce the glycosuria a little in patients living on a completely restricted diet, but they serve no particularly useful purpose. Salicylates can somewhat increase the boundary of tolerance, but they also irritate the kidneys and are apt

to derange the bowel function if given in doses sufficiently large to produce this effect. Alkalies are always useful in diabetes, both as hepatic stimulants and as antacids, *i. e.*, as a prophylactic against dangerous degrees of acidosis; they also aid pancreatic digestion in the bowel, and this is important. Organotherapy promises a great deal for the future but for the present it is impossible to declare anything definite in regard to this matter; that the various pancreas preparations utilized so far are essentially inefficient is established.

Most of the complications of diabetes, and among them the complications about the ocular apparatus yield, as a rule, provided serious destructive changes have not been brought about, to proper correction of the diabetic condition, especially to a proper regulation of the diet. This applies especially to the trophic disorders that are not uncommonly seen and to the skin disorders that may involve the lids. The tendency to furunculosis\* and purulent infections and the intractable character of the latter must be especially considered; here above all things scientific treatment of the diabetes is an essential prerequisite to proper treatment. Local measures alone rarely lead to the goal.

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\*Yeast given by mouth is often of signal value in diabetic furunculosis.

## CHAPTER XIV.

### TREATMENT OF CERTAIN SYSTEMIC DISEASES THAT INVOLVE THE OCULAR APPARATUS, CONTINUED.

*Toxemias, Continued — Rheumatism — Gout (Prophylaxis) — Rachitis — Blood Diseases—The Anemias—Progressive Pernicious Anemia—Simple Anemia—Chlorosis—Leukemia—The Hemorrhagic Diathesis —Scurvy—Hemophilia—Purpura—Schoenlein's Disease—Circulatory Disorders—Bright's Disease.*

#### **Rheumatism.**

The term rheumatism is a remnant of an ancient nomenclature and is loosely employed to designate a great number of morbid conditions many of them related in no way to one another. Used originally by the humoral pathologists to indicate the circulation of disordered "humors," it was later applied to a variety of fleeting pains in many parts of the body, *i. e.*, to a symptom. As such pains were commonly produced by exposure to cold and dampness, many disorders that followed such exposure were called rheumatic, so that the term was now used in an etiologic sense. As the joints were commonly affected in these disorders, the term rheumatism was then rather loosely employed to designate joint affections in general. Finally, a "rheumatic diathesis" was constructed in which there was said to be a special predisposition to articular involvement ("athritism" of the French).

Designated as "rheumatism" but not at all belonging to it are, first, acute articular rheumatism or rheumatic fever, an infectious disease; second, a variety of articular affections, grouped under the most unfortunate name "pseudo-rheumatism," that are of parasitic origin (staphylococcus, gonococcus, pneumococcus, diphtheritic, tuberculous, influenza bacteria); third, the acute articular lesions of gout. Muscular rheumatism is generally a myalagia, possibly a neuritis of the small muscular nerves.

"In fact the words rheumatism and rheumatic are often so loosely employed that they have almost forfeited all claims to be regarded as scientific terms." This from no less authority than A. E. Garrod. Nevertheless it appears necessary to discuss very briefly the treatment of that vague array of symptoms called rheumatic involving almost every organ of the body, including portions of the ocular apparatus, and commonly attributed to some derangement of the uric acid metabolism or to some altogether obscure underlying cause that

affects in most cases the joints and tendon sheaths, or that develops consecutively to articular lesions.\*

Prophylaxis is of the greatest importance and must concern itself chiefly with the general hygiene and the diet. The domicile should be dry, well ventilated and light, for moisture and lack of sunlight undoubtedly predispose to the development of the disease. Depressing psychic influences should be counteracted. The patients should be protected against exposure to wet weather or sudden temperature changes. The clothing is of the greatest importance; linen or cotton should never be worn close to the skin; for these textures favor rapid radiation of heat, become wet and cling to the body when the patient perspires and hence obliterate the layer of immovable air that should intervene between the skin and the first garment. Wool, flannel or silk are, therefore, the best.

The diet should be nutritious, without overloading the stomach. Underfeeding is especially to be avoided. The patients should drink plenty of water preferably some alkaline water with slightly laxative properties.

In cases that are "gouty," *i. e.*, in which a perversion of the uric acid metabolism can be postulated or definitely determined by careful metabolic studies the following dietetic considerations should govern the feeding of the patients:

There is much disagreement and misunderstanding in regard to the use of meat, some extremists interdicting the use of meat altogether; others making artificial distinctions between dark and red meats; others again insisting upon a diet consisting exclusively of red meat, "Salisbury diet." The use of moderate amounts of meat is not only permissible but necessary; some care, only, should be exercised in the selection of the kind of meat and its mode of preparation.

The chief source of circulating uric acid and its dangerous congeners, the purin bases, being the nucleins, every effort should be made to reduce the ingestion of articles of food containing the latter or their derivatives. Hence all meats containing many cell nuclei, *i. e.*, all internal organs, as liver, sweet-breads, kidney, brain, thymus, should be forbidden. All meat extracts, broths, sauces and gravies containing the so-called "extractives" of meat are equally bad, because they are solutions of the above mentioned purin bases, and the latter are rapidly converted into uric acid in their passage through the body; besides they are themselves possibly a prolific source of many of the

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\*For a classification of the different forms of "Rheumatism" and a discussion of the etiology as well as an attempt at arranging a suitable nomenclature for its many forms, see "*Clinical Therapeutics*," p. 161 ff.

troubles commonly attributed to the action of uric acid.\* To exclude the flesh of fowls because birds produce more uric acid than animals is based on wrong conclusions; and it has also been shown that there is no difference between dark and white meats, with this exception, that raw or underdone meats still contain some of the extractives, whereas thoroughly boiled meats do not; for this reason, too, boiled meat is safer than fried or roast meat. The most important point to remember is that the albumen of the meat proper exercises no direct effect on the uric acid economy but that the nucleins alone contribute to an accumulation of uric acid and its congeners. It is wrong to place these patients for indefinite periods of time on a vegetarian diet, for undernutrition is almost certain to result unless the metabolism is carefully studied and the diet arranged accordingly.

Too much meat on the other hand is also dangerous, for it produces acidulation of the blood stream in several ways and also leads to an increased digestion-leucocytosis that causes some uric acid increase by the disintegration of numerous leucocytic nuclei. Eggs may be permitted in reasonable limits; the same applies to milk. Cheese is poor in basic salts as they remain dissolved in the whey; hence it leads indirectly to blood acidulation owing to its failure to neutralize circulating acids derived from albumen oxidation. Empirically, in fact, cheese has been found to be especially detrimental and it is, therefore, best forbidden. Carbohydrates and fats can be taken practically *ad libitum* excepting in those, not infrequent, instances in which diabetes and obesity complicate the uric acid diathesis. Most vegetables are allowed, with the exception of young, germinating plants that contain abundant nuclein.

The best beverage is pure water, but not in excessive quantities, as it has been shown clearly that forced water drinking does not materially increase the uric acid or purin bases excretion, while impairing gastric digestion and seriously overtaxing the cardio-vascular apparatus. Mineral waters, especially of the alkaline variety, are useful; waters containing abundant lime are particularly valuable, as calcium possesses powers to a marked degree of preventing the precipitation of uratic deposits. Lithium waters, aside from the fact that most of them contain no lithium or at best only minimal quantities, and that lithium is of no greater use, popular prejudice to the contrary notwithstanding, than any other alkali, are not to be recommended in particular. In fact, the great benefits no doubt occasionally derived from a visit to some watering place are, as a rule, attributable rather more

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\*See Croftan, *The Role of the Alloxuric Bases in the Production*, etc.—*Am. Journ. Med. Sc.*, 1901.



to the change from the ordinary routine, to the regular life, to the rest, the fresh air and the exercise obtained, possibly also to the drinking of much water than to any healing powers of the salts that these different waters may contain.

Milk and buttermilk are both excellent beverages. Tea and coffee should be taken very moderately, also cocoa, and the less of alcoholic liquors a sufferer from uratic disorders ingests the better.

As to the medicaments little need be said. Abundant alkali in some form, preferably as sodium or calcium carbonate, careful regulation of the function of the digestive apparatus, *i. e.*, free evacuation of the bowel contents by mild laxatives, here and there an hepatic stimulant or an intestinal antiseptic as fully discussed in previous paragraphs. Most uric acid cases are best treated as cases of hepatic insufficiency (see above), for the derangement of the nuclein metabolism will be found to be chiefly connected with derangement of certain liver function.

#### **Rachitis.**

The successful treatment of rickets is largely hygienic and dietetic. Essential points are the supplying of plenty of light and air and of a dry domicile. The food element, however, is by far the most important determining factor, malhygiene being merely a predisposing factor. For a child may live in most unhealthy surroundings and not develop rickets provided feeding is properly attended to and may, on the other hand, develop rickets in ideal hygienic surroundings if the food factor is neglected.

In the production of rickets it will be found that three elements are deficient in the food, *viz.*:—fat, animal proteid and earthy phosphates. A deficit of lime salts cannot be accused of producing the disease, for children living on an abundant farinaceous diet containing much lime readily develop the disease. Overabundance of lactic acid as some claim, resulting from fermentative dissimulation of improperly digested farinaceous foods, cannot cause rickets for on the same diet the patients thrive, if only sufficient fat and proteid are added; besides, rickets develops in cases suffering in no way from lactic acid dyspepsia. These two theories are merely mentioned because they are so popular and so generally believed to be true.

Chronic intestinal disorders, especially if they produce vomiting or diarrhea and general undernutrition are an important factor; here the proteids and fats in particular are wasted as they must undergo certain changes in the bowel before they can be assimilated and are consequently sacrificed in greater proportion than the more rapidly assimilable carbohydrates. Here, then, we have practically a deficit

of fats and proteids. Any catarrhal conditions about the gastrointestinal tract therefore urgently call for correction as an essential preliminary to the treatment of rickets.

In view of the fact that many children cannot digest large quantities of milk casein, which would be the ideal proteid, the deficiency of animal albumen must often be supplied by raw meat juice. The meat juice may be given alone or to advantage combined with milk, for it can be mixed with the later without perceptibly flavoring it and above all without producing coagulation. In fact the addition of meat juice to milk seems to render the coagulates in the stomach finer and more flocculent hence more digestible. The deficit of fat should be made up by the addition of cream; this is the best source of fat for small children, and is to be preferred to cod liver oil. Lime should, finally, be supplied in the form of lacto-phosphate, not as lime water; for what are needed are earthy phosphates rather than the calcium itself.

Hydrotherapy and orthopedics of course play an important rôle in the treatment of this disease, drugs a very subordinate one. Phosphorus has been extensively tried and is not without value. It is rarely needed, however, if the above dietetic rules are carried out and phosphates in sufficient quantity incorporated with the food. If given at all it is best administered in combination with the cod liver oil in the dose of about half a milligram to a teaspoonful of the oil.

### **BLOOD DISEASES.**

#### **THE ANEMIAS.**

#### **Progressive Pernicious Anemia.**

In every case of pernicious anemia a careful search should be made for intestinal parasites and the appropriate anthelmintic treatment administered. If a parasitic origin can be determined, then the prognosis is not so bad as in nearly all the other forms of the disease, and energetic causal treatment becomes very much worth while. Here and there gastric atony underlies the disorder, occasionally syphilis. Sometimes malaria, filaria sanguinis, distoma hematobium may be the determining factor and the removal of these blood parasites leads to the desired goal. The pernicious form of anemia sometimes seen in pregnant women may call for the induction of premature labor.

In all other instances the treatment is purely symptomatic. The general hygiene should be ideal. Rest in bed for weeks is often highly beneficial. The diet should be carefully arranged in such a way that the patient is overfed while at the same time the exact secretory and motor powers of the digestive tract in each individual are carefully included in the calculation.

Of drugs arsenic is deservedly the most popular. It may be given

in the form of Fowler's solution or as arsenious acid or as the cacodylate of soda, by mouth or hypodermically. Of the latter preparation large quantities can be given hypodermically without producing any symptoms of arsenical poisoning. As much as a quarter of a grain twice a day can be given with impunity, and even larger doses for short periods of time. If Fowler's solution is used one should begin with ten drops in water or milk three times a day gradually increasing the dose a drop a dose a day until symptoms of arsenic intoxication make their appearance, *i. e.*, burning in the mouth, thirst, dyspeptic symptoms with eructations, pain in the epigastrium, puffiness about the face and red blotches in different parts of the body. Then the dose should be reduced. Some people possess a decided idiosyncrasy against arsenic and in them these signs appear at once on the exhibition even of small doses; here the drug should be discontinued promptly. If plenty of fat is given with Fowler's solution the drug is often better borne; the addition of a little laudanum to the arsenical solution also often counteracts the appearance of disagreeable digestive symptoms. If the patient is suffering from diarrhea the administration of the drug should not be begun until this is checked. Arsenious acid is best given in the form of "Asiatic Pills," containing some pepper, for the latter stimulates the flow of hydrochloric acid and aids in the rapid absorption of the arsenic, thereby preventing too great irritation of the gastric mucosa. One should begin with one such pill a day, gradually increasing the dose until six to ten pills are being taken each day.

Iron is not indicated in pernicious anemia. In fact it seems, at least in my experience, to do more harm than good. I have never seen any good effects from bone-marrow, nor from the administration of hemoglobin or other blood preparations. Transfusion of blood, however, is occasionally useful and should always be tried in desperate cases; sometimes the patients react to this procedure with violent chills, fever and sweats, cyanosis, dyspnea, all presumably due to a ferment intoxication. If such signs appear the infusion should be stopped at once. Some patients improve immensely after infusion, in some the results are negative and in some alarming signs develop. As most of the cases are desperate, the method is worth trying despite its uncertainty and many disagreeable features.

Transfusion of normal salt solution either intravenously or by hypodermoclysis is also occasionally useful and can never do harm. It is important to remember, however, that this disease is apt to present spontaneous intermissions and remissions so that therapeutic results are never free from ambiguity and should be interpreted with the greatest conservatism.

**Simple Anemia.**

The primary step in treating any form of secondary anemia is to discover the cause that is producing the impoverishment of the blood and to remove it. Occasionally, however, simple anemia will persist even when the underlying cause is removed, as, for instance, the anemia remaining after internal or external hemorrhage, profuse vomiting in pregnancy, intoxication by intestinal parasites and various infectious diseases. Or, the primary disorder producing the simple anemia may be very chronic in character or incurable; here the anemia attains almost the dignity of an independent affection urgently calling for correction, even though the underlying cause cannot be removed.

The diet should be arranged carefully according to the capabilities of the gastro-intestinal tract; and a study of the digestive function should be made in every case. Unfortunately the digestion is as a rule deranged in this disease owing to the malnutrition of the gastro-intestinal walls. At all events the diet should contain abundant albumen; meats of all kinds, milk, eggs. In addition plenty of fresh fruit and vegetables. Possibly articles of food containing large quantities of iron are advantageous, although this point is not definitely established. At any rate yolk of egg, spinach, apples, etc., may be advised. Carbohydrates should be given sparingly and fats only in relatively small quantities. That special diet rules must be formulated in cases suffering from organic gastro-intestinal disease is self-evident. Here and there it may become necessary to adopt rectal feeding for a time.

Proper feeding in anemia is often rendered difficult by lack of appetite; here the bitter tonics are of use, viz.:—tincture of cinchona, in one or two drachm doses; tincture of *nux vomica*, five to ten drops; compound tincture of cardamom, one to two drachms. A very useful but not altogether reliable remedy to stimulate the appetite finally is orexin to be given in five grain doses before each meal.

As anemic cases, owing to the hemoglobin deficit, the reduced oxidation processes, and the instability of the vaso-motor system, are very susceptible to temperature changes, the arrangement of the clothing is of the greatest importance. Inasmuch as loss of heat is best prevented by creating an immovable layer of air between the skin and the first garment, a material should be selected for underwear that is a poor conductor of heat, that rapidly absorbs perspiration from the surface of the body and permits slow evaporation of the absorbed moisture. The ideal material, therefore, is wool. In summer flannel and silk are less irritating to the skin. Linen and cotton should, however, never be worn by anemic patients. On account of the sus-

ceptibility of anemic patients to temperature changes cool or cold bathing should be altogether forbidden. Hot baths on the other hand are well borne and useful. If the patients can afford to do so they should be advised to seek a climate that is warm with the minimum of temperature changes and with low barometric pressure, *i. e.*, at moderate altitude, but not at the seashore.

The drug treatment of simple anemia consists essentially in the use of iron and arsenic. If there are severe gastro-intestinal disorders neither of these drugs should be given because they both irritate the gastric and intestinal mucosa. Nor should iron be administered to cases with pulmonary tuberculosis. I believe that it can aggravate the condition of these patients and may stimulate latent foci to renewed activity. It unquestionably can raise the fever. In nephritic cases arsenic is, of course, forbidden. In the presence of any of these complications the chief reliance should be placed on general hygienic means. Occasionally the iron and arsenic may be given by rectum while the gastro-intestinal trouble is being treated and is in process of healing; the iron in the form of a tincture of the chloride, as reduced iron or as dried blood; the arsenic as Fowler's solution. Or arsenic may be given hypodermically in the form of cacodylate of soda. (See *Pernicious Anemia*.) In administering iron it is important to remember that the patient should in some form receive about 0.01 gm. of iron each day. The exact preparation of iron is immaterial. Personally I prefer reduced iron or tincture of the chloride of iron to any of the organic iron preparations. In all cases of simple anemia a course of iron and arsenic should be continued for a considerable time after the regeneration of the blood has occurred as otherwise relapses are quite apt to occur.

#### **Chlorosis.**

The underlying taint seems here to be more a perversion of lymph formation than of blood formation. There is no anatomical evidence of disease of the blood-forming organs nor are there any marked quantitative changes about the cells nor any signs of degeneration. There is in every case of chlorosis a strong neurotic element manifesting itself chiefly about the vaso-motor system. The treatment of this disorder must therefore chiefly be directed against this neurosial element more than against any anemic condition of the blood.

Rest is the most important element in the treatment. The patients should be put to bed and kept there for several weeks; if possible removal from home surroundings should be arranged and the patient either sent to a hospital or given the benefit of care in an open-air

sanitarium. Removal from home combined with rest often alone effects a cure.

Certain hydrotherapeutic measures are also of great value. The same applies to massage. The details of these methods cannot be described within the narrow confines of this article. The diet should be arranged according to the secretory and motor condition of the stomach and intestine by following the general principles enumerated in previous paragraphs. One point may be emphasized in this place, viz., the advantage of using the abnormal cravings that most of these patients exhibit as a guide for the selection of diet. Some patients crave acids, others chalk or other alkaline material, still others highly spiced articles of food. These idiosyncrasies should be considered. Broadly speaking chlorotic subjects do best on a diet consisting largely of vegetables and cereals and containing a minimum of meat and other animal albumen.

As most chlorotics are constipated this diet is particularly indicated. Daily copious evacuation of the bowels should be accomplished as it is not impossible that underlying all cases of chlorosis will be found a chronic intestinal toxemia originating in persistent coprostasis.

The medicamentous treatment of chlorosis calls chiefly for iron; but this remedy can in no way be considered a specific, although it is frequently declared to be such. Many cases of chlorosis get well without iron and on the above simple regime; on the other hand many cases fail to improve even when very abundant quantities of iron are administered. Iron, nevertheless, is the best remedy we possess and it should be given in every case. The administration of iron is best accomplished by Blaud pills. I have never been able to convince myself that organic iron preparations have any determinable advantage over inorganic iron. Perchloride of iron (through a tube to save the teeth) and reduced iron are both useful. The name of official and unofficial iron preparations is legion and it would be useless to enumerate them all. If there are severe gastric symptoms, gastritis, gastralgia, gastric hyperesthesia iron should not be given at all until these troubles are relieved.

Arsenic is less important in chlorosis. Small doses of Fowler's solution or of arsenious acid or cacodylate of soda can, however, do no harm. Mineral waters containing iron and arsenic are a convenient and pleasant way to administer these two remedies. Bottled iron waters are as a rule useless as most of them contain the iron in solution as carbonate of iron; the carbonic acid soon escapes and the iron precipitates; under these conditions the water contains very little iron in solution. It is well, therefore, to advise the drinking of ferrugin-



ous waters, not bottled, but at their source; in this way, too, the patient obtains the benefits of resort life, change of scene, etc. And it is probable that in most instances the latter factor is by far more beneficial than the drinking of the iron waters.

### **Leukemia.**

The treatment of all forms of leukemia is unsatisfactory in so far as effecting a cure is concerned. By judicious treatment life can, however, be prolonged and the patients rendered comparatively comfortable. Here, as in so many other diseases, it must be remembered that spontaneous remissions occur and that the results of any treatment are always ambiguous. The use of drugs in leukemia is always fraught with some danger as the antitoxic function in these patients is as a rule low; hence drug intoxications are very apt to occur; for the same reason violent forms of auto-intoxication following digestive derangements are quite common.

The remedy that seems to be of the greatest value is arsenic. It should be administered as in pernicious anemia (see above). It is best to give it in the form of cacodylate of soda hypodermically. Injection of arsenic into the lymph glands or into the spleen, a procedure that has been widely advocated, I consider altogether precarious and worse than useless.

Quinine, best given as the muriate in five to fifteen grain doses three times a day, preferably in combination with arsenic, seems occasionally to exercise a marked effect on the blood picture and the general symptoms. Phosphorus, too, empirically is known to do some good; it can do no harm, when administered in the form of iron phosphate with quinine and strychnine.

Organic extracts of spleen, lymph glands, bone marrow are advocated. I have never seen any benefits derived from their use. Oxygen in extreme cases affords great relief but exercises no curative effect. Tuberculin and erysipelas toxin have been used on the basis of some good effects seen in leukemics when intercurrent tuberculosis or erysipelas supervened. However true the latter observation may be in isolated cases, the adoption of the toxin treatment is to be condemned as altogether too precarious.

X-rays have been used extensively in this disease within the last years. Symptomatically very startling results are occasionally seen manifesting themselves by a rapid reduction in the size of the spleen and a great drop in the number of leucocytes. These phenomena are not infrequently accompanied by general symptoms that impress one as toxic and that are in all probability due to the leucolysis produced by the X-ray treatment. All the cases that I have had treated

in this way finally had a relapse and ultimately succumbed to the disease within three years, at the latest, after they came under observation. After a relapse has once occurred the splenic tumor does not seem to yield so readily to X-ray reduction and often it does not yield at all. The same applies to the leucocytosis. Nevertheless, the X-rays should be given a trial in each case of leukemia if for no other reason than that, in favorable instances, great symptomatic relief is given by the reduction of the splenic tumor. Together with the X-rays a thorough course of arsenic should also be administered.

#### **The Hemorrhagic Diathesis.**

Scurvy, hemophilia and purpura constitute a category of diseases of obscure etiology that are grouped under the general name of the hemorrhagic diathesis. The three disorders are more or less related to one another; hemophilia in most cases being attributable to an hereditary transmission of a tendency to bleed and being a permanent condition, whereas scurvy and purpura are always acquired; the former appearing endemically, the latter sporadically; the former usually as the result of malnutrition, the latter rarely dependent upon definite external conditions. Even in scurvy and purpura, however, one is almost forced to the conclusion that a congenital predisposition to hemorrhages exists.

#### **Scurvy.**

The food factor is the most important in the treatment of scurvy. The absence of sufficient potassium salts, the lack of sufficient vegetables and fruits, the lack of sufficient fat have all been accused of producing the disease. In the practical treatment of the disorder, at all events, fresh vegetables containing abundant potassium salts, viz.: chiefly potatoes, spinach, cabbage, watercress, turnips, carrots, onions, artichokes, oranges, asparagus, and in addition milk, fresh meat, containing blood, and meat extracts should above all things be abundantly supplied. Combined with rest in bed this diet, as a rule, without further medication, suffices to cure all cases of scurvy in adults or in children.

Prophylaxis is of course very important. Lemon juice abundantly administered is a useful measure. Ideal hygienic conditions with plenty of fresh air, abundant light and a dry domicile are important elements. Of medicines horse radish (*herba cochleariæ*) is popular. Tannic acid, quinine, yeast (200-300 gm. daily) have all been recommended.

The treatment of surface hemorrhages and of the gums consists chiefly in the application of styptics and thorough cleanliness; chief

reliance should be placed upon the correction of the underlying taint; with the later removed, the hemorrhages will stop of their own accord.

### Hemophilia.

For the ophthalmic surgeon this disease is important. Bleeders are troublesome patients; and any means that can be adopted to allay the tendency to hemorrhages must be welcomed. A member of a bleeder family should for some time preceding any contemplated operative inroad, however slight, be placed on a diet as described under scurvy. Alcoholic beverages, tea, coffee, condiments and spices should be reduced.

Here again lemons are the most popular remedy and there is no question in regard to the power in some cases of citrates of potassium and sodium to reduce the hemorrhagic tendency. Mineral acids, sulphuric acid in particular, deserve a trial; dilute sulphuric acid may be given in doses of ten to fifteen drops in water several times a day, or sulphate of magnesium or sodium may be administered instead. Ergot, hydrastis, opiates are all advised but are of indifferent value.

As a preliminary to an operation or during an operation, if intractable hemorrhages should develop, subcutaneous injections of gelatine may be tried. The greatest care should of course be exercised that the gelatine solution is altogether sterile on account of the danger of a tetanus infection. From 5 to 200 c.cm. of a 2 to 3 per cent. solution of gelatine in normal salt solution, heated to the body temperature may with impunity be injected under the skin. This occasionally stops the bleeding. Calcium chloride that has been recommended on the supposition that the coagulability of the blood owing to a calcium deficit is reduced, is of no value. Surface hemorrhages should be treated with adrenalin chloride and other local styptics according to ordinary surgical principles.

### Purpura.

(*P. simplex, hemorrhagica, rheumatica, syn. Peliosis rheumatica, Schoenlein's disease, Morbus maculosus of Werlhoff*). The clinical differences between these different forms of purpura are very artificially constructed. At the bottom of all these disorders is an hemorrhagic tendency, a pale, vulnerable skin and anemia. The causes are not defined. Here and there an infectious agent (*bacillus purpuræ Letzerich*) can be accused; in others a ferment intoxication; in still others there is a chronic endarteritis with fragility of the vessel walls.

The treatment is largely symptomatic. Rest in bed, a diet such as the one described in scurvy, abstinence above all from articles of food and drink that can excite the vaso-motors, *i. e.*, coffee, tea, alcoholic beverages, spices, condiments. In the beginning, therefore, practically

nothing more than milk, cereals, cream, water, lemonade, orangeade. The evacuation of the bowels should be promoted and the intestinal tract thoroughly cleaned out at frequent intervals. Intestinal parasites should always be carefully looked for and if found promptly removed.

There is no specific remedy. Sulphuric acid, as in hemophilia, has been declared to be a useful drug. Arsenic in the form of Fowler's solution is always indicated. Ergot is warmly recommended. Salicylates and other "anti-rheumatic" remedies may fitly be given a trial. The chief reliance in this as in all the other manifestations of the hemorrhagic diathesis should be placed upon proper hygiene and diet and not upon drugs.

### ***CIRCULATORY DISORDERS.***

On the borderland between the toxemias and the circulatory disorders that can produce disturbances about the ocular apparatus lie exophthalmic goitre and the syndrome Bright's disease.

#### **Exophthalmic Goitre, Graves' Disease.**

Without entering upon any of the numerous theories that have been advanced to explain the origin and the significance of the cardinal symptoms of Graves' disease, I content myself with the statement that in the overwhelming majority of the cases the symptoms presented resemble in all essential particulars those produced artificially by the administration of excessive doses of thyroid preparation. The syndrome is practically one of "hyperthyroidism." It is important to expressly mention this in order to definitely discredit the plan of administering thyroid preparations in this disease. However useful such preparations may be in those disorders in which the thyroid function is deficient (myxedema and cretinism are prototypes) so useless, even dangerous, are they in any form of hyperthyroidism. It is a peculiar evidence of the common carelessness in prescribing that this "therapy" is nevertheless so frequently practised.

The use of the serum and the milk of thyroidectomised animals that has been extensively advocated of recent years is based on a more rational foundation; unfortunately the clinical results so far are quite uncertain. Personally I have never seen any effects from this treatment that could not have been obtained as well and with less expense and annoyance to the patient from the ordinary means employed in the treatment of Graves' disease. In this disorder spontaneous remissions and intermissions are very apt to occur and one must be exceedingly conservative in attributing good effects to any one remedy. This applies, for instance, to thymus therapy. The results are ambiguous; the

remedy is worthy of trial and has this advantage over thyroid that it has never been known to do any harm.

In far advanced cases that fail altogether to yield to the simple measures to be presently described surgical intervention must be thought of, partial or complete thyroidectomy being the remedy of choice in most cases. Provided the operation is performed by a *very skillful* and experienced surgeon, provided so much of the gland and capsule (accessory thyroids) are not removed as to produce tetany, the results are really astonishingly good. The operation should never be looked upon as a routine measure, however, to be resorted to promptly in every case of Graves' disease, but always as an emergency measure and a means of last resort.

One of the most important general measures to be employed in any case of exophthalmic goitre is the maintenance of complete rest, physical, mental and emotional, for a period of weeks, if possible. In most cases it becomes necessary, in order to accomplish this, to take the patients away from their home surroundings and to give them a change of scene. In aggravated cases a hospital or a sanitarium are the best place. If a resort is selected, the altitude should not be over 2,000 feet. The seashore is never good for these cases.

The question of diet is still a subject of controversy. Personally I have seen the best results from an abundant albuminous diet combined with plenty of fresh fruit, cereals and vegetables. The proteid metabolism is usually very active in Graves' disease so that it becomes necessary to supply the deficit arising from the rapid disassimilation of body albumens; in other words, to put it crudely, it is necessary to "feed the goitre." There are some arguments against this mode of therapy, but this is not the place to discuss them. The objection that a "meat toxemia" may develop from this diet is theoretically constructed.

Electricity has a decided place in the treatment of Graves' disease. The galvanic current with the anode applied below the angle of the jaw, the cathode, in the form of a flat plate electrode, applied to the left of the lower cervical spinal ganglia, is the best mode of applying the current. Weak currents, not to exceed one milliamperé, and applied for not longer than three minutes, should be used in the beginning. The direction of the current may be changed to advantage during these three minutes, and both sides of the neck should be galvanized. Later the strength of the current may be increased. The high frequency current applied directly over the thyroid gland has recently been extensively used and seems to act beneficially in some cases. Hydrotherapeutic treatment should be carried out with great care and under careful control of the heart action and bloodpressure. It

is directed against the neurotic phenomena more than the underlying disease and should be administered according to the common principles applicable to this class of disorders.

The medicamentous treatment of exophthalmic goitre is not very satisfactory. Iron and arsenic may be employed as in the anemias (see above). Here and there a little bromide and valerian may be indicated. Phosphate of soda in 30 to 60 grain doses two or three times a day seems to exercise a particularly beneficial effect upon the nervous mechanism governing the heart. The best remedy for the palpitation in tachycardia is aconite given in very small doses at intervals of from one to three hours. Digitalis has no place in the treatment of this disease unless there be evidence of cardiac insufficiency. Iodine is commonly used in Graves' disease, on what grounds has never become quite clear to me. Personally I have invariably found it to do more harm than good in this disorder.

#### **Bright's Disease.**

In all forms of chronic nephritis cardio-vascular signs develop sooner or later; and it is often a difficult matter to determine whether the changes about the heart and arteries are the primary event that produces the nephritis, or whether the nephritis causes retention of excrementitious bodies that poison the heart and arteries or, finally, whether the same primary cause simultaneously affects both the cardio-vascular apparatus and the kidneys. From a therapeutic point of view it is very important to decide this matter. In Bright's disease we seem to be dealing with a toxemia that involves simultaneously the heart, the arteries and the kidneys. Bright's disease in the modern sense is a systemic disorder that usually produces nephritis, but does not invariably do so; whereas chronic nephritis while often due to Bright's disease may also be due to a great many other causes.\*

The most important point to remember is that in Bright's disease the determining feature is high arterial tension with resulting cardio-vascular changes and nutritional disorders in various parts of the body and particularly in those organs that are supplied by *end arteries*, namely, the kidneys, the brain and the retina. The proper treatment of this so-called vascular type of nephritis is, therefore, practically synonymous with the treatment of the cardio-vascular apparatus; for cardio-vascular disorders generally usher in these forms of nephritis, manifesting themselves often in high tension, cardiac hypertrophy, retinitis before albumen appears in the urine; or they appear soon after the nephritic signs become apparent; and cardio-vascular complications

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\*See Croftan, *Circumstances and Treatment of Bright's Disease*.—*Jour. A. M. A.*, 1906.



generally produce the death of these patients. Cases of this type of nephritis should be treated, therefore, more as heart cases than as kidney cases.

The most important element in all these cases is to combat or prevent the toxemia that, in all probability, produces both the cardiovascular changes and the nephritis. Whereas the exact character of this toxemia is still obscure, the preponderance of clinical and experimental evidence points to a disordered gastro-intestinal tract and liver as the source of these poisons. Treatment should, therefore, in most cases be directed towards correcting any digestive or hepatic disorders that may be present, according to the principles discussed in previous paragraphs. Here intestinal antiseptics and all the means intended to correct perversions of the functions of the stomach and bowel that have been discussed under other headings have their place.

In arranging a diet for any case of Bright's disease three conditions must be fulfilled. First, the diet must contain qualitatively and quantitatively all that is needed to maintain general nutrition (nutritive equilibrium). Second, the diet must contain as little as possible of materials that in their ultimate passage through the kidneys can irritate the renal epithelia or the glomeruli. Third, the diet, while sparing the kidney function, must not overtax or otherwise injure the functions of the digestive or circulatory organs.

A word may be said in this place in condemnation of excessive milk feeding in chronic nephritic cases. Unless enormous quantities are given, nutritive equilibrium cannot be maintained with milk alone, for if sufficient milk is given to satisfy the caloric requirement, then a large excess of albumin is always administered. Milk, moreover, is greatly deficient in iron. Finally, the administration of the enormous quantities of water that must be administered with milk given in sufficient quantity is decidedly bad practice; for it is manifestly a precarious matter to persistently flood the circulation with immense quantities of fluid thereby overtaxing precisely those organs that it is intended to spare, namely, the heart and the arteries. Excessive milk feeding, moreover, gradually becomes disgusting and deprives the patient of that normal psychic stimulus of appetite and enjoyment of meals that is necessary to perfect digestion.

In selecting a diet for a nephritic case, only a few articles of food need be permanently excluded. Some reduction should be made in the administration of albumins, but care should be taken never to go below the necessary daily albumin requirement equivalent to about 60 to 80 grams in the 24 hours. Certain meats should be excluded altogether from the diet on account of the extractives and toxic prin-

ciples that they contain. To this class belong all raw, rare, smoked, cured and corned meats, because they still contain the extractives. Soups, bouillons and meat extracts, as well as most gravies also contain the extractives in solution. Internal organs like liver, spleen, kidney, brain, pancreas contain very abundant nuclein; and, as nuclein, in process of digestion is split up into purin or alloxuric\* bodies, a group of substances that are distinctly toxic and can both irritate the kidneys and the cardio-vascular apparatus, these articles too, should be excluded. All spices and condiments should be forbidden. In the selection of other articles of food, the idiosyncrasies of the patient and the condition of the gastro-intestinal tract should be taken into consideration in each individual, so that it is impossible to formulate any fixed diet rules applicable to every case.

As to beverages the amount of liquids should, as a rule, be restricted, particularly if evidence of myocardial degeneration or of arterio-sclerosis has become apparent. An occasional "drinking day," on which abundant water drinking is permitted is at times useful, because it aids in ridding the body of excrementitious material that accumulates. Alcohol should be completely forbidden, especially in the form of cordials, liqueurs, absinthe, because these beverages contain essences and flavors (aldehydes) that are excessively irritating to the liver and the kidneys. Tea and coffee are theoretically contra-indicated in chronic nephritis. Rather than have the patient, however, suffer from the hardship that the withdrawal of these accustomed stimuli entails, a little weak tea or coffee had generally better be allowed.

An important rule in feeding nephritics of any type is the reduction in the amount of table salt. In edematous cases it will be found that this practice, especially when carried to the complete withdrawal of chlorides, frequently leads to the disappearance of all puffiness.

The medicamentous treatment of Bright's disease is a matter of very subordinate importance. What drug treatment is used should be directed towards improving the condition of the cardio-vascular apparatus as indicated in the following paragraphs. There is no remedy that can exercise any healing influence upon the kidneys; *per contra*, most drugs decidedly irritate these organs. The less medicine, therefore, one gives in Bright's disease the better. Here and there it may become necessary to stimulate catharsis and diaphoresis, but these are emergency measures and must be considered means of last resource. What symptomatic treatment it is intended to carry out is

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\*See Croftan, "*The Use of Simple Hydrotherapeutic Means in the Treatment of Chronic Nephritis.*"—*Med. Fortnightly*, 1903.

best undertaken by means of hydrotherapy; here a large and useful field opens up, but, within the narrow frame of this chapter, it is impossible to enter into any of the details. The selection of a proper climate and altitude is, of course, of the greatest importance in all very chronic types. Here similar principles should govern the choice of a resort as in heart cases. The so-called surgical treatment of Bright's disease is mentioned merely to be altogether condemned.

## CHAPTER XV.

### TREATMENT OF CERTAIN DISEASES THAT INVOLVE THE OCULAR APPARATUS, CONCLUDED.

*Circulatory Disorders—Arterio-sclerosis—Valvular Diseases of the Heart—Infectious Diseases—Malaria—Diphtheria—Acute Articular Rheumatism.*

#### **Arterio-sclerosis.**

Loss of elasticity or fragility on the part of the arterial walls is an important element in the production of certain complications about the ocular apparatus. Unfortunately the treatment of arterio-sclerosis, when the condition is once fully established, is very unsatisfactory. It is important, therefore, to recognize the early onset of this disorder and to immediately adopt those prophylactic means that can, in many instances, prevent the complete development of arterio-sclerotic degeneration of the cardio-vascular apparatus. In the majority of cases, of course, arterio-sclerosis is merely an evidence of senility, premature or normal, and here any causal treatment is manifestly impossible. A small minority of cases of arterio-sclerosis are, however, due to distinct metabolic disorders as gout and goutiness, diabetes, obesity, to a variety of chronic intoxications and chronic forms of intestinal derangements, as well as to the abuse of alcohol, tobacco and lead and, finally, to syphilis. The causal treatment of all these forms of arterial degeneration is synonymous with the treatment of the underlying conditions and has been discussed in appropriate paragraphs elsewhere.

Symptomatic treatment must chiefly concern itself with preventing hypertension of the peripheral vessels, in other words, with keeping down the blood pressure. The general dietetic rules to be observed are the following:

Alcoholic beverages and tobacco, as well as tea and coffee, should be forbidden altogether. Meat should be reduced, and particularly those varieties of meat and meat preparations known to contain extractives, should be eliminated from the diet. A diet, therefore, consisting largely of milk, plenty of fresh fruits and vegetables, cereals and moderate amounts of fats is the best. Above all things, however, great care must be taken not to chronically underfeed the patient. The ingestion of liquids should be somewhat restricted. The same

principles should govern the choice of a climate or an altitude, the employment of bathing, or other hydrotherapeutic means in these cases as in cases of valvular heart disease with decompensation. (See below).

The medicamentous treatment of arterio-sclerosis consists first in the use of iodides, either of potash or sodium, preferably administered in combination with some alkali, as bicarbonate of soda. A very useful routine method of administering iodides and alkalies is the exhibition of 2 to 10 drops of the saturated solution of iodide of sodium in a glass of milk, to which is added one-third of a teaspoonful of bicarbonate of soda. Iodides are best given after a meal. They should never be administered together with acid foods nor should they be given patients suffering from gastric catarrh, and they should never be administered in a metal spoon. In order to prevent the development of iodism the administration of the iodides should be interrupted from time to time. The exact mode of action of the iodides in arterio-sclerosis is not known and it is useless to discuss the numerous theories that have been advanced to explain their action.

The nitrites may also be used in order to reduce blood pressure. They are best administered in the form of a nitrate combined with sodium bicarbonate, as the nitrates undergo reduction to nitrites in the body; or nitrite of soda may be given in tablets or solution in the dose of 1 to 2 grains. Heart tonics should be given with care in arterio-sclerosis on account of the inability on the part of the arteries to adapt themselves rapidly to blood pressure changes. In cases of cardiac insufficiency, however, developing later in the disease with low blood pressure, digitalis administered continuously in small doses, say, for instance, of one drop of the tincture three times a day, is of decided value.

#### **Valvular Diseases of the Heart.**

The object of treatment in valvular diseases of the heart is to aid the organism in maintaining the balance of compensation or in restoring it after it has begun to fail. It is unnecessary to discuss the treatment of the different valvular lesions separately; for the manifestations of the different single and combined heart lesions are in most cardinal respects similar, that is, in nearly all cases there is hypertrophy and dilatation of different portions of the heart, myocardial and arterial degeneration with changes in the blood pressure and ultimately venous stasis and cardiac dropsy in different organs.

The oculist is particularly interested in the correction of venous stasis, anemia, hyperemia and increased peripheral tension about the ocular apparatus resulting from cardiac lesions, hence the treatment of these particular manifestations of valvular disease alone will be dis-

cussed in these paragraphs. The above conditions rarely develop unless there is failing compensation. Absolute rest in bed is here a prime condition for restoring the balance of compensation. It is difficult, as a rule, to persuade patients in early stages of decompensation to go to bed, but it is absolutely essential that the situation should be fully explained to them and they be compelled to comply with this order. Rest in bed to be efficacious should be continued for weeks. The results obtained are frequently brilliant and very often one will be able to get along very well without the use of any other treatment. The diet should consist of milk and cream, a little fresh fruit, an egg or two a day, a little meat and some cereal. The administration of liquids should be considerably reduced. Cold applied continuously or intermittently to the precordial region is a valuable adjuvant to the treatment. If compensation is not restored within a week or ten days by this simple expectant plan or, if the patient is seen for the first time when decompensation is far advanced and edema and congestion of different organs are present, then it may become necessary to use heart tonics.

To discuss the whole group of heart tonics, their indications and contra-indications in this short chapter is altogether impossible. I will limit myself, therefore, to discussing very briefly the main points in the use of digitalis, the chief heart tonic.

The main effect of digitalis is exerted upon the ventricles, stimulating them to increased contraction, provided the heart muscle is not in an advanced stage of decompensation. Digitalis also raises the peripheral blood pressure and at the same time slows the action of the heart. Finally, by causing an increased determination of blood to the heart muscle, it improves the general nutrition of the heart. The dose is very important, for large amounts of the drug frequently produce an effect that is exactly opposite to that exercised by small doses, that is, they reduce the force of the systolic contractions and, in lethal doses, cause arrest of the heart in diastole. Its action is tardy as it is slowly absorbed, so that a day or two may elapse before the effect of the drug becomes apparent; hence there is always danger of cumulative action, especially as the excretion of digitalis is as slow as its absorption. Finally, the personal equation must be considered, some individuals showing a marked susceptibility, others an equally remarkable tolerance to its action. It is important, therefore, always to begin with small doses and during the first days of its administration to carefully watch the heart, the pulse and the blood pressure for signs of digitalis poisoning. It is claimed that some of the pure principles of digitalis possess only a cardiac action without the dis-



agreeable local or general effects. Most of these principles, however, are quite uncertain in their action and vary much in strength. Their use should be reserved, therefore, as a rule, for those cases that display an absolute intolerance against the ordinary preparations of digitalis. Sometimes a case of valvular disease comes under observation for the first time with a very slow and intermittent pulse, great muscular weakness and certain gastric and cerebral symptoms. If, on inquiry, it is found that such a patient has been taking digitalis for a long time, it is always well to tentatively stop or greatly reduce the use of the drug in order to rule out the possibility of chronic digitalis intoxication. For a heart that is alarmingly slow as a result of digitalis poisoning 1-200 grain of atropin hypodermatically should be given as an antidote.

Digitalis and the whole group of which it is a member are contra-indicated in any case of failing compensation in which the heart muscle has begun to degenerate, notably in advanced myocarditis and fatty heart. In diseases of the aortic valves digitalis should be given with the greatest care. Extensive atheroma or fragility of the arterial walls is also a contra-indication to the use of digitalis; for here the increased pressure may lead to rupture of the vessel walls.

Of the many preparations of digitalis a fresh infusion or the tincture are, from a practical point of view at least, best. Of the former the dose is 1 to 2 fluid drams (4 to 8 cc.), of the latter 5 to 15 drops (.03 to 1 cc.) three times a day. Occasionally patients do not react properly to the infusion or the tincture. In such cases the use of the powdered leaves in doses of from 1 to 4 grains (00.3 to 00.07 gm.) is indicated.

The glucosides, digitoxin, digitophyllin, digitalin and digitalein have been somewhat used. I have found it unnecessary in the great majority of cases to have recourse to these preparations. For failing compensation strychnia may occasionally be used. As it acts chiefly upon the vasomotor center in the medulla and the general nervous system, it slows the heart beat by its stimulating effect upon the cardio-inhibitory nerves. It should never be used as a heart tonic when arterial tension is high. Caffein, another useful drug, strengthens the heart muscle, raises the peripheral blood pressure and increases diuresis. This drug should never be given when the peripheral blood pressure is high, nor should it be used in very excitable individuals, nor in alcoholics. It is particularly valuable as a substitute for digitalis in cases in which the heart muscle is beginning to degenerate or has degenerated, because caffein presumably exercises its effect not upon the heart muscle directly but upon the nervous

apparatus governing the heart beat. In extreme cases of cardiac failure, in which no time is given to gradually strengthen the heart by the use of heart tonics, it becomes necessary to have recourse to such drugs as camphor, ether and ammonia as emergency measures.

### **INFECTIOUS DISEASES.**

Among the acute infectious diseases producing ocular complications only those three will be discussed in particular in which specific treatment is possible; for in the majority of cases it will be found that specific treatment directed against the underlying infection speedily brings about improvement or cure of any ocular complications that may be present.

In so far as most acute infectious diseases are in a sense self-limiting and display a tendency towards spontaneous recovery, the chief duty of the physician is to imitate the methods put forward by Nature towards restoring normal conditions. In most cases, in the deplorable obscurity of our ignorance, his activities remain limited to creating ideal conditions about the patient, thus enabling the victim of the disease to put forward his best efforts towards checking the infection. Here and there it may become necessary to strengthen, to reinforce, to stimulate reactive processes when they begin to flag, to hold them in check when they threaten to exceed safe bounds. This applies with particular emphasis to the fever movements.

#### **Malaria.**

The use of quinine as a specific renders the treatment of malaria simple. As very large doses of quinine are prone to produce disagreeable symptoms, the attempt should be made to produce the desired effect with the smallest possible quantity of the drug. The treatment of the paroxysms varies according to the type of malaria.

In the quotidian variety the patient should receive fifteen grains of quinine twice, 6 and 5 hours before the time when the attack is expected. In this way the attack may occasionally be aborted. If administered at the same time and in the same way on the second day, the attack is in the great majority of cases stopped. It is best, then, to continue the administration of 30 grains of quinine for two or three days longer in the same manner. In cases in which careful blood examinations are not made and in which, consequently, the type of malaria is not positively established, it is particularly important to continue the administration of quinine for several days, because one may be dealing with two or three colonies of quartan fever, so that it would be necessary to administer quinine for at least four

or six days in succession in order to destroy all the parasites in the amebic stage.

If the patient is seen for the first time with an attack just impending, or, if the attack occurring on the preceding day was exceedingly severe, so that it is particularly desirable to prevent the occurrence of another attack, then 15 to 45 grains of quinine should at once be administered hypodermatically. If, on the other hand, the patient is seen for the first time during an attack, then it is altogether useless to give quinine in the simple intermittent form of malaria. If, finally, the patient is seen after the attack and if the seizure was very severe and especially if the exact type of malaria is not yet established, then 15 to 20 grains of quinine should be given at once and the same dose repeated on the next day about five or six hours before the time of the expected paroxysm.

In atypic, intermittent types of malaria and in the sub-continuous pernicious variety no definite rules can be formulated in regard to the exact time for administering quinine. It is always a safe rule to give from 10 to 15 grains of the drug by mouth every four or five hours for several days. It will often be found that the type of the disease then changes to the simple, intermittent type which should be treated as indicated above.

In the pernicious type of malaria with severe apoplectic symptoms, coma or tetanic convulsions, quinine in doses of 15 to 30 grains should be given at once intravenously and the dose repeated every twelve hours for several days.

Quinine may be given as indicated above by mouth, by rectum, hypodermatically and intravenously. If much gastric irritation develops from the administration of quinine by mouth, or if it is desired to obtain a rapid effect, the administration by rectum in clysmas or suppositories may be adopted. Still more rapid effects are obtained from the hypodermic administration and almost immediate effects from the injection into the veins.

The most common preparations are the muriate and the sulphate of quinine; the former containing percentically more quinine than the latter and being more rapidly absorbed. In very nervous individuals, or in subjects in whom the administration of quinine exercises an irritating effect upon the nervous apparatus, the valerianate or bromide of quinine may be given. A useful preparation is euquinine, particularly in children; for it does not possess the bitter taste nor most of the toxic properties of the ordinary quinine preparations while it is equally effective. For hypodermic use the hydrochlorid (quinine bimuriate) is the best. It should be dissolved

in about 2-3 c. c. of water. The addition of a little urea to the quinine bimuriate increases its solubility in water and renders the injection less irritating. For rectal use a little opium should be added to the quinine solution in order to counteract the irritating effect of quinine salts on the rectal mucosa. The best preparation for intravenous use is the one recommended by Bacelli, namely,

R	
Quinine hydrochlorate	1.0
Sodium chloride	0.075
Distilled water	10.0

Some individuals unfortunately possess a marked idiosyncrasy to quinine rendering it impossible to administer the drug at all. They all respond to the administration of even small doses with signs of cerebral congestion, disturbances of vision, smell and hearing, nausea, vomiting, headache, dizziness, maniacal attacks or somnolency verging on coma. In such instances it may become necessary reluctantly to forego the use of the drug and to attempt the treatment of the malarial paroxysm by some other means. Only in the pernicious type should quinine be administered notwithstanding any idiosyncrasy on the part of the patient that may exist; for here the best and the most rapidly acting remedy must by all means be given in order to save the patient's life; and the personal sensations of the individual need in no way be considered.

Chief among the remedies that can take the place of quinine is methylene blue in doses of two to four grains (0.1 to 0.2 gm.) by mouth or in dram doses of a five per cent. solution hypodermically. In case strangury develops after the use of methylene blue, the addition of *nux muschata* to each capsule of methylene blue often counteracts this disagreeable symptom.

Eucalyptus, a drug that may be given either in the form of the fluid extract in one dram doses several times a day, or as the alcoholic tincture in two to four teaspoonsful doses, or as eucalyptol in ten to fifteen minims, in capsule, two or three times a day is also often efficient.

One is rarely called upon to consider other drugs than quinine, methylene blue and eucalyptus. A very distinct place in the treatment of malaria is, however, occupied by arsenic; for this drug, while of very little value in the treatment of acute cases and while without lethal effect upon the plasmodium, is highly useful in protracted, chronic, sub-acute forms of the disease, especially with malarial cachexia. Arsenic is best administered in combination with quinine,

either in the form of arsenious acid, sodium arseniate, or as Fowler's solution, or, best of all, hypodermatically as the cacodylate of soda in one-half to one grain doses in watery solution once or twice a day.

### **Diphtheria.**

Provided antitoxin in the proper dosage is given sufficiently early in this disease complications in diphtheria are exceedingly rare. Many of the local measures that formerly occupied so important a place in the treatment of this disorder have, therefore, become superfluous.

The injection of antitoxin should be made into the subcutaneous tissues, not into the muscles or the fasciæ, nor into any of the superficial cutaneous veins. The best locations for the injections are the external surfaces of the thighs, the abdominal parietes and the upper pectoral region. A proper syringe, sterilized and ready for use is nowadays furnished with every package of antitoxin. If necessary an ordinary Pravaz syringe can, of course, be employed after sterilization. Rigid surgical asepsis of the field of the injection should be practised.

The ordinary dose for children under ten years is five hundred units if given on the first day; a thousand units if given on the second day. In children over ten years, and in adults, a thousand units should be given at once and if the symptoms are not very much improved in twenty-four hours, a second thousand should be given and, if necessary, a third thousand at the expiration of another twenty-four hours. If the case is seen in an advanced stage, *i. e.*, on the second or third day of the disease, or if signs of laryngeal involvement have made their appearance, then the first injection of a thousand units should be followed in six to twelve hours, according to the reaction of the patient, by a second thousand units and in another six to twelve hours by a third injection of a thousand units. It will hardly ever become necessary to give more than three thousand units, for after this amount of antitoxin has been injected and the patient fails to show marked improvement, further doses of antitoxin will generally be without effect.

It has been claimed that antitoxin may cause heart failure, paralysis, albuminuria, nephritis and other serious complications. It is true that cardiac failure and paralysis occur as frequently in diphtheria cases that are treated with serum as in cases that are allowed to run their course without antitoxin injections; in fact, some statistics seem to show that more cases of diphtheria (that survive!) develop signs of heart intoxication when treated with antitoxin than without; but one is justified in assuming that these cases would have died had they not received the benefit of antitoxin treatment; so that the figures

revealed by these statistics in regard to the occurrence of cardiac complication are exceedingly misleading and in no sense justify the conclusion that the serum produced the phenomena about the heart and the peripheral nervous apparatus. The albuminuria, renal complications, urticaria, arthritis, etc., that sometimes follow the administration of antitoxin are due to the injection of large quantities of a foreign serum and not of the antitoxin itself; this is borne out by the fact that nowadays when small quantities of a more concentrated serum are used in place of the large quantities of a dilute serum formerly employed, these sequelæ, notably the albuminuria and the skin eruptions, are exceedingly rare. There is, therefore, no compelling reason why antitoxin should not be liberally injected in any case of diphtheria that presents itself.

Other medicines in the overwhelming majority of the cases are not only superfluous but actually harmful. Antipyretics especially are as a rule dangerous to the heart. In some European clinics inunctions of mercury and silver salts are practised with, it is claimed, good results. The reports are so positive and sound so convincing that as an adjuvant to the antitoxin treatment or as a substitute in case the antitoxin cannot be promptly secured these inunctions may be tried. From 15 to 30 grains (1 to 2 gm.) of unguentum hydrargyri, or fifteen to forty-five grains (1-3 gm.) of Credé ointment are rubbed into the skin in different parts of the body for two days; on the third and fourth day the dose of the ointment is increased about one-third. Inunctions should never be made about the region of the neck.

#### **Acute Articular Rheumatism. (Rheumatic Fever).**

Salicylic acid and its numerous derivatives must be considered almost a specific in this disease. It apparently exercises some influence upon the nerve ends, chiefly in the joints, relieving the pain; it may also possess some antipyretic and specific antitoxic action. In order to be effective large doses of salicylic acid preparations should be given, *i. e.*, as much as sixty to one hundred and twenty grains in the 24 hours and for several days in succession. In other words the remedy is best given in doses of from ten to fifteen grains every three or four hours for several days in succession. Under this plan symptoms of salicylate poisoning occasionally develop. If they are mild it is safe to continue the use of the drug, possibly changing to some other preparation (see below) than the one originally used. If they are severe and manifest themselves within a short time after the administration of the first doses as severe visual disturbances, congestion about the head, buzzing in the ears, dizziness, nausea, vomiting, then it generally becomes necessary to stop the use of salicylic acid preparations alto-



gether. This applies particularly to those cases in which a peculiar idiosyncrasy against the drug exists. Here a single dose may produce a violent reaction with headache of a most severe type, delirium, retardation of the pulse, palpitation, drenching sweats and coma.

There are certain other contra-indications to the use of salicylates besides the appearance of intoxication symptoms, viz.:—acute renal congestion and advanced degrees of chronic nephritis, cardiac disorders, gastritis and any condition that is accompanied by congestion about the cerebral vessels.

The most commonly used salicylic acid preparations are: salicylic acid, sodium salicylate, aspirin, salol, salophen, salicin and oil of wintergreen. Salicylic acid itself acts a little more quickly than the other preparations but it is more irritating to the stomach than any of its congeners. It should always be given in capsule or powder, preferably with a little milk as its solubility is very small. Its solution in any alcoholic menstruum is so irritating as to preclude its administration by mouth in this form. Sodium salicylate is best given in solution in some syrup or flavored water. The dosage of the two is alike, viz., ten to fifteen grains repeated. Children under one year should never, however, receive more than fifteen grains in the whole 24 hours and children from two to six not more than 30 grains, children from six to twelve not more than 60 grains in 24 hours.

The least irritating preparation of salicylic acid and the one least apt to produce toxic symptoms is aspirin. It should be given in 30 to 45 grain doses three or four times in 24 hours in powder form with a little milk. It will hardly ever become necessary to use any of the other salicylic acid preparations enumerated above. The dosage of the dry preparations among the latter is approximately that of aspirin, of the oil of wintergreen twenty drops in milk or a capsule every two to three hours. In cases of severe gastric irritability the percutaneous method of administering salicylates may be tried. Ointments containing one part of salicylic acid to ten parts of lanolin, or containing equal parts of oil of wintergreen and lanolin are particularly useful.

If it is impossible to give salicylates in any form, then recourse must be had to other remedies that in a measure can replace the salicylates. Chief among the latter are certain coal-tar preparations notably lactophenin 10-15 grains, phenacetin, 5-10 grains, antipyrin, 5-15 grains, all three or four times a day. Salipyrin, a combination of antipyrin and salicylic acid is always useful. Of late years particular attention has been bestowed upon guaiacol preparations, and justly so; very startling results are often seen from its use when exhibited in capsule or powder with a little milk in 10 to 15 grain doses three or four times a day. Of

other remedies nothing need be said. Mention should merely be made of alkalies in any form, for a vigorous alkali therapy in combination with other methods is always indicated in this disease.

A discussion of the local treatment of the afflicted joints and of the general measures to be employed lies without the frame of this article.

# CHAPTER XVI.

## THE TREATMENT OF THE MORE IMPORTANT DISEASES OF THE NERVOUS SYSTEM THAT AFFECT THE EYE.

BY D'ORSAY HECHT, M. D., CHICAGO.

*Cerebrospinal Meningitis—Septic Meningitis—Tuberculous Meningitis—Syphilitic Meningitis—Cerebral Arteriosclerosis and Apoplexy—(Hemorrhage—Thrombosis—Embolism)—Encephalitis — Infantile Cerebral Paralysis—Amaurotic Family Idiocy—Hydrocephalus—Toxic Encephalopathies from Lead and Alcohol—Brain Abscess—Brain Tumor—Facial Paralysis—Facial Spasm—Trifacial Neuralgia—Ophthalmoplegia—Bulbar Palsies—Myasthenia Gravis (Asthenic Bulbar Palsy).*

### Meningitis.

Confronted with septic meningitis due to an invasion of the pia by a streptococcus or staphylococcus, the endemic form seen in infants, the tuberculous and syphilitic types or finally the epidemic cerebrospinal meningitis caused by the diplococcus intracellularis of Weichselbaum, we are impressed with the fact that in all forms the pathological process may be sufficiently extensive to implicate the entire convexity of the brain and more commonly the base, inclusive of all the cranial nerves. That being the case, it is not strange that ocular manifestations are at some time conspicuously present in one or all of the varieties of meningitis. In the septic forms the convex pia is a favorite site; in the meningitis of infants the base is more often involved; the tuberculous variety is preponderatingly basilar; likewise the syphilitic type, in which a degenerative neuritis is present involving the more anterior of the cranial nerves at the base, especially the optic and oculomotor. In the epidemic form the pia of both brain and cord is affected.

Consistent with this localization, neuro-ophthalmologic observers assert the possibility in meningitis of (1) pupillary inequalities and irregularities; (2) iridoplegia; (3) strabismus; (4) nystagmus; (5) optic neuritis and atrophy; (6) exophthalmos; (7) hippus; (8) ocular paralyses; (9) keratitis.

### Cerebrospinal Meningitis.

*Prophylaxis* in this disease means the quarantine of an already existing case and careful disinfection of all things brought into contact with the patient, thus limiting the transfer and spread of the contagion. An examination of the nasopharynx and tonsils of those exposed to

the disease, including the bacteriologic findings, is also indicated. A good general and better local resistance to infection goes far toward protecting the individual.

*Symptomatic treatment.*—*Lumbar puncture* has been advocated in meningitis by some for its curative effect and by others for its positive palliative value. It certainly occupies a place of increasing importance in the diagnosis of many nerve lesions, and its rôle in the modern serum treatment of cerebrospinal meningitis in particular justifies, I believe, an extended reference to it as a therapeutic measure.

The claim made in behalf of its specific action is based upon the results following (1) withdrawal of numerous bacteria; (2) removal of pus; (3) reduction of intracranial pressure; (4) diminution in the toxicity of the spinal fluid. Its success as a palliative is estimated by the early and prompt relief of the patient from intense headache, delirium, convulsive seizures, fever and even the coma, resulting in a marked general improvement.

The puncture should be made after the manner described by Quincke. The patient should be brought near to the edge of the bed, placed upon the left side, and the back made as convex as possible by inclining the upper part of the body forward and bringing the flexed thighs and knees near to the chin. The left horizontal lateral position is to be preferred for puncture, since it affords the greatest possible anterior curvature of the spinal column, and causes better separation of the arches of the lumbar vertebræ. If for any reason a left position is undesirable, the right lateral should be chosen, but a sitting posture is always to be discouraged. The site for puncture is usually selected between the third and fourth lumbar vertebræ. Quincke states that the *third intervertebral space is generally the best*, although the fourth and fifth, and even the second, may be used. For the better determination of the fourth lumbar spinous process, which is a good landmark for the point of puncture, it is well to remember that it is on a horizontal line with the upper border of the iliac crest.

The lumbosacral region should be prepared aseptically as for any major operation, and if a patient's fear, unrest, spasm or coma makes necessary the use of a local anesthetic, the ethyl chloride spray or Schleich solution (cocaine sol., gr.  $\frac{1}{2}$ -4 per cent.), hypodermatically given, will be found useful. In the average muscular adult, it is well to make the skin puncture one-half to one centimeter to the right or left of the median line, inclining the needle, however, toward the head and in the median plane. In children, where the vertebral spines, ligaments and muscles are but slightly developed, the needle should be directed to the median line in the plane of a horizontal transverse sec-

tion of the trunk, penetrating the dural sac at the shallow depth of from one to three centimeters.

Upon entering the dural sac, resistance ceases and sometimes a sharp pain is felt, but the operator should also determine his location by the depth to which the needle has penetrated. In frail adults, especially women, an insertion of from four to six centimeters only is necessary, when fluid escapes. Well-developed, muscular men require a penetration of from seven to eight centimeters, and in stout people or those with edematous tissues ten centimeters of the needle may be necessary.

When the dural sac is reached the steel stylet or mandrin fitting into the hollow needle (one to one and a half millimeters in diameter by four to ten centimeters long) is withdrawn and the cerebrospinal fluid allowed to flow. If pressure within the canal is great, the flow will be very free, and if not increased, the fluid will exude drop by drop, but during the entire operation it is well to keep the needle in such position as will favor the exit of the fluid. The amount of fluid to be withdrawn will depend upon the individual case. In a general way, it may be said that anywhere from a few drops to forty cubic centimeters may escape without harm to the patient, but the withdrawal of fifteen to twenty cubic centimeters at any one time should suffice in the majority of cases. Repeated punctures may be made with safety, if they are performed with technical care and a proper regard for asepsis. Concetti subjected one patient fifty-three times, and I have frequently had occasion to repeat it five or six times in the same case.

If a purulent fluid clogs the cannula, it should be slightly withdrawn and the stylet reintroduced, to render it patulous.

The entire operation is relatively painless, especially if the patient remains quiet; the discomfort of cutaneous puncture lasts only a moment, burrowing in the deep musculature causes no distress, but not so the penetration of the periosteum or spinal dura, which often causes a sharp pain, rather distinctive enough to denote entrance into the canal. At the close of the operation the proper technic is completed by sealing the point of puncture with a cotton collodion patch.

The fearful mortality of cerebrospinal meningitis has undergone great reduction since the advent of the *Flexner serum*, and although it is much too recent for the last word to have been spoken concerning its exact position in the therapeutics of this disease, quite enough clinical data are at hand to indicate that in this serum we have a most potential remedy.

The technic of administration is simple and consists of a lumbar puncture done with intent to draw off, if possible, 30 c.c. of cerebro-

spinal fluid, and allowing an equal volume (30 c. c.) of serum to run into the spinal canal, through the puncture needle, which has not been disturbed. Similar to the first practices in giving diphtheria antitoxin, this serum is poured from a bottle into a large-sized syringe, which is then attached to the needle, already in place, and under some pressure made upon the piston (if that be necessary), the fluid enters the canal. It is not always possible to withdraw the requisite amount (30 c.c.), of fluid, and in some instances none may escape, in which event 10 to 20 c.c. of serum may nevertheless be introduced, without giving rise to undesirable pressure symptoms. Flexner suggests, that before using, the serum be heated to body temperature by immersing its container in warm water. Thirty cubic centimeters constitutes the average dose for a single injection, to be repeated three or four times, at intervals of from twenty-four to forty-eight hours, depending upon the rate of improvement.

A most recent analysis of 400 serum-treated cases, tabulated by Flexner himself (Flexner and Jobling, *J. A. M. A.*, July 25, 1908), confirms the good report of an earlier series, viz., 75 per cent. recoveries and 25 per cent. deaths. From the literature to date, it is to be inferred that Flexner's anti-serum (1) has greatly reduced the mortality in epidemic cerebrospinal meningitis from a seventy or eighty per cent to a twenty-five per cent. death rate. (2.) It can and should be used at the earliest possible period in the disease. (3) It greatly changes the clinical complexion and course of the individual case, lowering temperature by lysis or crisis, relieving symptoms and lessening the liability to sequelæ. (4) It should be repeated so long as symptoms remain. (5) In some cases, especially the chronic ones, it seems to have little or no good effect.

The patient, on account of the unusual degree of cerebral irritability, should lie in a room with very subdued light and removed from all sources of intrusion and noise. The head should rest in elevation on an ice-bag placed at the nape of the neck and spine, and an ice-cap be applied to the head. When the temperature continues to exceed 103° F., cool sponges or baths are indicated. When temperature is not so high and the restlessness is extreme, the prolonged warm bath (90° to 100° F.) given every three or four hours for a half-hour at a time has a marked sedative effect, but the utmost care must be exercised in the matter of lifting and moving the patient. Too active purgation, as formerly practiced, has been discarded in favor of a *mild catharsis*. In vomiting of the cerebral type the remedies used in acute gastritis are unavailing and *bromides* in large doses per rectum are most serviceable. The intense cephalalgia, restlessness and convulsions



as well as delirium are best controlled by small and repeated hypodermics of morphine, gr. 1-12 to  $\frac{1}{4}$ , although I have seen great benefit derived from the use of small doses of *veronal* (grs. ii to iii), given every three or four hours for days at a time.

Resorbents, either in salve or plaster form, are recommended by a few, but, in my opinion, all, with the possible exception of unguentum Credé, are valueless in this particular form of meningitis.

Since the soluble silver preparations have been regarded as effective in the septic and septicopyemic conditions occurring in children, they have been given a trial in meningitis, and are looked upon with favor. *The unguentum Credé* in the amount of  $\mathfrak{z}$ i to  $\mathfrak{z}$ ss, rubbed into the skins of infants and children once daily, and oftener, if indicated, is said to be absorbed in sufficient amount to allow of a favorable action from the silver therein contained. In adults it is less readily absorbed, and another colloidal silver preparation, *collargolum*, given by mouth, per rectum or intravenously, may be substituted, and is said to give good results. It is put into a vein in the amount of three to five c.c of a 1 to 5 per cent. solution, and when given rectally, five to seven grains are dissolved in water.

Counter-irritants, once popular, are no longer used.

A supportive treatment by food and alcoholic stimulation is of the utmost importance. Nourishment should be given by nutrient enemata or nasal feeding, and brandy or champagne, given often and in adequate doses, relied upon to combat the toxemia.

During recovery moderate doses of iodide are thought to do good.

As for special eye symptoms relating to the optic nerve, choroid or retina, they are likely to terminate in blindness, but their treatment, together with that of keratitis, must be left entirely to the ophthalmologist.

Surgical intervention is not called for in so diffuse a disease process, but Macewen reports six cases of cerebrospinal meningitis operated upon, with one recovery.

#### **Septic Meningitis.**

*Prophylaxis.* This form of meningitis is always secondary to an infection or suppurative process located elsewhere in the body, but especially about the head. Naturally, then, its *prevention* will depend largely upon the care and attention of antecedent conditions, such as otitis media, sinus disease, nasopharyngeal infections, facial erysipelas, skull fractures, scalp wounds, and injuries to the head.

*Casual Treatment.* When it is evident that a meningitis has developed by extension from middle ear diseases, a radical mastoid operation, undertaken with a view to get free, thorough drainage, should be

performed without delay. Brain abscess, whatsoever the cause, and sinus thrombosis should receive surgical attention before meningeal symptoms appear.

*Symptomatic Treatment.* The same general plan of treating meningeal symptoms discussed under the cerebrospinal form applies here. A quiet, darkened room, with ice-bag and cap to neck and head, sedatives for restlessness, narcotics for pain, antipyretics and hydrotherapy for fever, and lumbar puncture for symptoms of intracranial pressure, such as headache and optic neuritis, are indicated and serviceable. To reduce temperature, relieve pain and allay restlessness, *antipyrin* has met with more favor than other coal tar derivatives. Some authors advise keeping the patient well under the influence of opium or morphine throughout the entire early course of the disease; that is, before coma supervenes. The *bromides* and *chloral* may be given per rectum in liberal doses to control cerebral and general nervous irritability. Their action in children, who tolerate large doses well, is especially gratifying.

When convulsions appear, nothing controls them more promptly than *chloral*, given alone, per rectum, in fair-sized, even large doses, or combined with sodium bromide.

The bowels should be kept freely open, and in children, calomel given early and in small doses, gr. 1-10 to  $\frac{1}{4}$ , serves well for this purpose. If coma is present and depletion desirable, croton oil, m. i to ii, dropped on the tongue will afford prompt action. When the heart requires stimulation, alcohol may be moderately given, but camphor (gr. i to ii), ammonium carbonate (gr. ii to v), or caffeine citrate (gr. i to iii), are to be greatly preferred. There is great scope for nursing skill in these cases, including, as it does, the prevention of bed sores, the cleanly care of the eyes, mouth, nose and ears, and a plan of proper feeding.

*Surgical Treatment.* A trephining operation for septic meningitis is theoretically a reasonable measure, but in reality it has been attended with poor success. A localization of the inflamed pia, even when the process is circumscribed, is not easy, and the advice to operate is hardly ever given early enough; therefore, the disappointments in this field of work. The cases successfully operated by Macewen were circumscribed and of otitic origin. At the present time *lumbar puncture* as a minor surgical maneuver affords the best chance for improvement and even cure.

#### **Tubercular Meningitis.**

The prophylaxis and casual treatment of this affection consists in the proper treatment of tuberculosis. In the present state of our

knowledge, meningitis of this type can hope for nothing from radical measures, and gain but little temporary relief from palliation. The symptoms are to be treated as they arise. Nothing is to be gained in this type from the newer methods of tuberculin therapy.

### **Syphilitic Meningitis.**

This form, with its more deliberate onset, and close resemblance to brain tumor in the development and march of the symptoms, affords ample opportunity for a thorough and fair trial of rational treatment. In the presence of gummatous deposits and exudation, rational treatment means *anti-specific treatment*. If the need is urgent, deep intramuscular injections of corrosive sublimate may be used, but, on the whole, the inunction method of administering mercury is to be preferred. (*Vide*, Treatment of Syphilis of the Nervous System.) After one or two weeks of mercury, iodide of potash in doses of from grs. xv to xxx, three times a day, may be added, increasing same to massive doses, given in large dilutions of water or milk. Promoting the patient's strength by the best of hygienic measures and a generous nutritious diet, and maintaining the resistance at its highest point should, in conjunction with vigorous anti-syphilitic treatment, result in fairly good recovery.

### **Cerebral Arterio-sclerosis.**

*Synonyms: Endarteritis deformans; atheroma; arterio-capillary fibrosis; angiosclerosis.*

Arterio-sclerosis is an affection of the walls of the small or large arterial vessels, limited or diffuse in extent, involving not infrequently the entire vascular system. The process is in the nature of a regressive change, at first malnutritional, followed by a compensatory overgrowth of fibrous tissue, eventuating in a loss of elasticity to the intima and weakening of the media.

Since the structural and functional integrity of every part of the body depends upon an adequate blood supply, it is perfectly obvious that any morbid process impairing the vessel wall or impeding the blood flow is likely to produce in a related part sufficient organic change to be evidenced by marked clinical symptoms. The *cerebral circulation* when defective affords an excellent illustration of this fact, since most of the brain lesions commonly met with in practice have to do primarily with disease of the cerebral blood vessels. Far greater importance attaches to the effect of a rupture or stoppage of a vessel than to the underlying arterial disease. An endarteritis causes *thrombosis* and *embolism* and finally, by dilatation and weakness of the vessel wall, rupture and *hemorrhage*. In either instance disintegration of brain tissue ensues, with corresponding arrest of cerebral function.

The *visual apparatus* is not exempt from the influence of atheromatous changes and sclerotic processes occurring in the brain. The optic chiasm and optic nerve undergo changes evidenced clinically in hemianopsia and atrophy. In some cases of general arterio-sclerosis the ophthalmoscope reveals sclerotic changes on the retinal arteries. Pupillary anomalies are observed. These pathologic conditions, together with others mentioned elsewhere in greater detail, are referred to here merely to justify the therapeutic considerations of arterio-sclerosis, chiefly cerebral, that follow.

*Prophylaxis.* Arterio-sclerosis, when more or less general, lends itself to treatment with difficulty unless the many irritative conditions underlying and responsible for the vascular changes are well taken into account. Interstitial nephritis, diabetes, the various diatheses, of which gout, rheumatism and arthritis are the most important, the acute infectious diseases, infections and poisoning from lead, should receive early and proper treatment, and so delay the appearance of arterial changes.

Since chronic alcoholism is said to cause twenty-five per cent. of the cases, spirits or alcohol in any form should be used in greatest moderation, or, better still, absolutely interdicted. As one writer has aptly put it, "Could we ensure everybody against excessive bodily and mental strain, we should go far to obviate arterial changes and their allies, concomitants and results." All observers are agreed in emphasizing the dangers of the "strenuous life" as causative of vascular change and disturbance, and yet much, if not all, such advice is met by the laymen with stolid indifference and utter disregard. The demands of modern methods of business and living are naturally opposed to the forms of restraint and reserve encouraged by the doctrinaires of the simple life. Moderation in all things, food, drink, work and play, is observed in the breach but not in the practice, and I incline to believe with others, that little is to be gained for the patient by the insistence of preventive measures until our modern institutions of industry and society shall have undergone some radical and far-reaching reforms. Suffice it to say that in the reduction of excesses of all kinds we have the first solution of prophylaxis against inelastic arteries and insufficient vascularity of the body tissues.

*Physical Treatment.* A person suffering from beginning endarteritis should be made to understand and value the importance of regular habits of living. *Moderate exercise* is desirable, but never to a point of fatigue, profuse sweating or cardiac palpitation. Walking and golf are probably the most desirable of the outdoor activities, to be supplemented by morning and evening indoor calisthenics. Gymnastics

are too active, and by that same token tennis and rowing are to be interdicted. Every *sudden exertion*, even when not violent, should be guarded against. Obesity, whenever a factor, requires special instruction as to exercise, while localized massage to the abdomen or other parts should prove of additional value. The cold morning plunge, attended as it invariably is with sudden shock to the circulation, is to be avoided, and the hot bath as well. *Tepid bathing* in water ranging from 92° to 98° Fahr., is desirable. The special Nauheim baths are indicated except where there is reason to believe that the cerebral vessels are badly sclerosed and the blood pressure is low.

*Dietetic Treatment.* A diet should be prescribed in accordance with the needs of the individual. The food should be simple, non-irritating, easily digested, nutritious and taken in such amount and at such regular intervals as to preclude gastro-intestinal fermentation and distress. There has been some question as to the admission of nitrogenous values in the dietary. A vegetarian meal, with white meats, is preferred, but red meats are to be occasionally allowed. Eggs are permitted, and milk taken daily in large quantities, as recommended by Huchard, has found favor with Oppenheim and others. Condiments and strong coffee are harmful and should be dispensed with.

*Medicinal Treatment.* The feasibility of a routine administration of *iodides* as first advocated by Huchard, although questioned by some authorities, has, on the whole, met with favor. That iodine preparations materially influence endarteritis of other than luetic origin is doubted, and yet there are those who continue to be impressed by their action on any and all exudative and connective tissue processes. Hence the use of potassium or *sodium iodide* in small doses for a protracted period of time in every case of arterio-sclerosis. Huchard has advised doses of from fifteen to forty-five grains, given daily for twenty days, to be followed after a free interval of ten days by appropriate doses of nitroglycerine. When atheromatous degeneration is of known syphilitic origin, there can be little or no question as to the expediency of an early and thorough exhibition of the iodides in some form. (Vide, Treatment of Syphilis of the Nervous System.)

The *nitrites* (sodium nitrite in solution, gr.  $\frac{1}{2}$  to the teaspoonful) taken after meals more or less continuously have proved efficient in relieving high arterial tension. In more urgent instances nitroglycerine or its derivatives may be administered in doses of from gr. 1-100 to gr. 1-50, three to four times daily. Erythroltetranitrite (Merck.), in pill or tablet from (gr.  $\frac{1}{2}$  to gr. 1) is said to be more prolonged in its effect than nitroglycerine.

Cardiac tonics are directly injurious, and therefore contraindicated.

cated. Morphine in small doses is a valuable nerve sedative and cardiant.

Due observance of these precautionary and pallative measures should check the tendency of sclerosed vessels to progress to the point of obliteration or rupture.

### **Cerebral Apoplexy.**

Endarteritis in its local form as it affects the brain most frequently results in an attack of apoplexy, which, depending upon the cause, hemorrhage or softening, requires an intelligent therapeutic attitude.

*Treatment. Cerebral Hemorrhage.* Even when the liability to error in diagnosis is not great, a negative kind of service, one of "masterly inactivity," is the wisest course to pursue during the first hours and even day or so, after the onset of the stroke. *The desire to want to do something in the presence of a sudden and grave situation should be suppressed.*

Utmost care should be observed in moving and examining the patient. No attempt should be made to arouse him from coma. The clothing should be cut away rather than subject the patient to unnecessary manipulation and moving. *Posture.* Ensure absolute quiet, with the patient placed on the back or side, the head high, the neck extended and free. Posture, according to Bowles, has much to do in overcoming stertor and suffocative symptoms. Place the patient preferably with the non-paralyzed side downward, thus allowing for the better escape of accumulated saliva and easier respiratory expansion of the affected side. *Venesection.* The uncertainty of diagnosing hemorrhage makes bleeding a very doubtful, if not objectionable, measure. Starr comments upon its harmlessness, except in cases of weak heart and feeble pulse, and thinks it should be "employed much more freely than it is in cases of cerebral hemorrhage." In robust, plethoric individuals, with deeply reddened, injected features, full tension pulse, strong heart action in unusually protracted and deep coma and symptoms otherwise pointing to intracranial bleeding, venesection may be properly advised. Twelve to eighteen ounces may be taken from the arm at once in a single bleeding. A few selected cases in which I have seen this done showed a reduction of arterial blood pressure, but no apparent amelioration of symptoms. *Digital compression of the carotids* at both sides of the neck for a half hour or so is another method of reducing intracranial blood pressure. Circulation may also be diverted from the brain by sinapisms to the lower extremities and hot foot packs. It must, I think, be conceded that the ice-cap to the head is more agreeable than effective. *Nutrition.* No attempt should be made at feeding a patient until there is a show of willingness to take



food. Patients suffer from water, not food loss during the first twenty-four or forty-eight hours, and should at best on the second day after onset (while yet in coma) receive small *enemata* (one pint) of sterile warm water, with a view to retaining same. Under no circumstances should food be given by mouth until the ability to swallow with ease has returned. The only nourishment for the first three or four days should consist of *cold milk and water*. If swallowing causes much annoyance or coughing, *nasal feeding* through a small catheter is indicated. Nutrient enemata or normal saline solution (one pint) per rectum may be continued for days at a time. *The bowels* should be freely opened from the first, even to the degree of depletion. During unconsciousness, one to three drops of croton oil in butter, a little sweet oil or simple syrup put on the tongue affords certain, rapid and free purgation. *Elatarium* is of service.

If great *restlessness* (apoplectic motation), muscle twitchings or convulsions occur, they are best controlled by chloral hydrate in fifteen grain doses, or sodium bromide, grs. xxx to 5i, in emulsion, and given per rectum. A few whiffs of chloroform may suffice. *Sleeplessness* yields best to veronal in a dosage not to exceed seven grains, or trional, ten grains, given with a cup of hot milk to accelerate the soporific action. *The skin surfaces and mucous membranes* should be given early and careful attention. The corners of the mouth, the nose and the eyes should be kept free from mucous discharges and crustings by repeated cleansing with saturated boric solution. The bed linen and sheets should be free from wrinkling and the *extremities* kept separated, since close apposition at the ankles or of the fleshy parts of the limbs tends to develop decubitus. Immediate changes of soiled linen and cleanliness of the parts after evacuation of bladder and bowels is imperative.

When *urinary retention* is present, catheterization as often as every three hours may be resorted to.

When the extremities are cold, *external heat* may be applied, but always with *great caution*, since the lowered vitality of the paralyzed parts predisposes to the production of sores and ulcerations.

Supportive or stimulating measures are only indicated in the presence of cardiac or respiratory failure.

*Surgical Treatment.* If the location of extravasated blood, either on the surface or subcortical, could be determined with precision, the question of trephining to remove an intracerebral clot would be worthy of consideration. Starr reports McBurney's success in undertaking this in a case of traumatic hemorrhage, with subsequent good recovery.

*The Chronic or Postplegic State.*

Rest should be insisted upon for at least a month after the apoplectic onset, the patient not being allowed to make even a voluntary effort in turning in bed. Gradually the diet is amplified, but should remain non-stimulating (except in thrombosis). The patient is allowed to move the paralytic side some each day. A sitting posture is gradually encouraged. Warm water sponge baths and mild alcohol rubs are refreshing and sedative.

Potassium iodide in small doses is approved by some writers. Massage may be recommended as early as the third week after onset, and given twice daily for about twenty minutes at a time, together with passive movements and mild faradism, will accomplish much by way of improving local nutrition and circulation, and enable better voluntary return of motion as soon as muscle power reappears. The co-ordinating exercises elaborated by Frenkel in his treatment of locomotor ataxia are also of avail in hemiplegia (*vide* *Tabes Dorsalis*).

The treatment of special defects, such as aphasia, athetosis, hemianesthesia, will be disregarded, but in a text devoted to ocular manifestations it might be pertinent to add that hemianopsia is not amenable to cure or improvement. It is always best, however, to keep the patient uninformed of its presence, or if he becomes cognizant of it, to disabuse him of it as much as possible.

The patient's mental state is often one of perturbation, more especially as he awakens to a full realization of his disability. Much can be done by the exercise of tact and rare judgment to relieve these anxieties. The friends and family should know from the first how transitory or permanent the symptoms are likely to be, and the patient may be so advised, that largely depending, however, upon his temperament.

**Cerebral Thrombosis.**

The *prophylaxis* alluded to under arterio-sclerosis applies here. In the first hours of the attack, it is highly important to recognize in the feeble pulse, flagging heart action and facial pallor the clinical picture of thrombosis.

The patient should be placed flat in the bed, with the head low and the feet elevated, thus promoting the better flow of blood through the affected vessel. Elevation of the foot of the bed accomplishes this without interfering with the patient. Supportive treatment must be instituted without delay, to consist of heart stimulants, strychnine, digitalis, strophanthus in appropriate doses, caffeine citrate, or sodium salicylate and caffeine (Starr), grs. iii, every six hours. Alcohol in form of whisky or cognac is indicated, and if pulse tension is high, a hypodermic of 1-100 gr. of nitroglycerine. External heat should be applied

to the body, and the early and free administration of fluids not neglected. Coffee, hot beef tea and hot milk, given by mouth or per rectum, should be advised as soon as the patient regains consciousness. Contraindicated in this condition are all drastic or depleting cathartics—venesection and cold affusions to the head. If delirium and headache are present during the so-called reactionary stage, bromides are valuable, but phenacetine, acetanilid and sundry coal tar products must be avoided. The general treatment, dietary, observance of cleanliness, etc., is the same as in apoplexy from hemorrhage.

#### **Cerebral Embolism.**

Little can be said of treatment here that has not already found expression under hemorrhage, except that *depletory methods by venesection or free purgation are absolutely contraindicated*. Emboli are not removable. Rapidly acting stimulants, such as camphor, strychnine or ammonium carbonate, are of cardinal service in strengthening the heart's action and establishing as quickly as possible a strong collateral circulation. If this be not the aim from the first, irreparable softening of brain tissue must follow. If convulsions appear, chloral hydrate in doses of fifteen grains every hour may be given, but it is unsafe to give more than three consecutive doses. The onset and late symptoms are treated expectantly by rational measures of rest and diet.

#### **Encephalitis.**

*Synonyms: Acute hemorrhagic encephalitis; polioencephalitis superior and inferior.*

An acute inflammatory process, invariably of acute infectious origin, occurring mostly in children, but in adults as well, and confined, as a rule, to a single small area in the brain, perhaps pin-point in size, or multiple and disseminated. Whether of the acute hemorrhagic variety affecting children, or in the alcoholic type of Wernicke, occurring in adults, a partial or complete ophthalmoplegia is the symptom of first importance, and optic neuritis is often noted.

*Treatment.* There can be no rational prevention since the acute infections, toxemias and exanthemata overtake the patient suddenly and are not amenable to abortive measures. Timely abstinence is good advice, when chronic alcoholism is the cause.

The treatment during the acute febrile stage is entirely symptomatic, with the same regard shown for absolute quiet, rest, elevation of the head, as obtains in brain hemorrhage.

Cerebral irritability, restlessness and headache are best relieved by the ice-cap, cool sponges or small doses of phenacetine, quinine or the salicylates. Active catharsis is desirable from the very time of onset. The use of unguentum Credé (grs. xv to 3i) seems indicated in

these cases, and is surely worthy of trial. *Collargolum*, another colloidal silver preparation, has received both attention and acknowledgment in this disease. It may be given per rectum in solution or intravenously 3 to 5 c.c. of a 2 per cent. solution for as many consecutive doses as there is demand. The injection is painless and its effect is good. For the delirium, which is likely to be marked and sometimes associated with convulsions, morphine, opium and the milder somnifacients, such as veronal, trional, sulphonal and chloralamide,, are indicated. In adults suffering from the alcoholic type, the best combatant of delirium, especially in young, robust individuals with marked motor restlessness, is *hyoscine hydrobromate*, gr. 1-150 to gr. 1-50, given hypodermatically, and I have frequently seen its narcotic effect greatly enhanced by the addition of morphine sulphate, gr.  $\frac{1}{8}$  to gr.  $\frac{1}{4}$ . It must not be repeated often and its failure to act at all in some cases must be understood. Opium should be given only as a last resort, and not at all when arterio-sclerosis is noted. Alcoholic stimulation in these cases should not be entirely withdrawn, and general stimulants are of use as urgent symptoms arise.

The convalescence calls for such general measures as are mentioned under apoplexy. Electricity is of use in the chronic stage. It has been customary to advocate mercurial inunctions and iodides for the remaining focal symptoms, but their administration is of very doubtful value.

The late postplegic state, with its deformities and contractures, may require the orthopedic or surgical correction referred to under infantile cerebral palsies, but intracranial operative interference is quite out of the question.

#### **Infantile Cerebral Paralysis.**

Apart from the vascular causes of permanent paralyses, most often hemiplegic in type, numerous other factors, including those that are prenatal, contribute to the maldevelopment of the brain, as a result of which varied clinical forms of paralysis persist, associated with other manifestations of gross cerebral defect, such as feeble-mindedness, idiocy, epilepsy, deaf-mutism and total blindness. The lesions are necessarily different in kind, origin and location, and only the occasional incidence of visual defect (Starr series: hemianopsia in three, blindness in seven) warrants a brief allusion to treatment.

*Prophylaxis.* The prenatal and natal causes of cerebral defect suggest the advisability of careful attention to the period of pregnancy and labor. Since syphilis may be contracted by the parturient woman, the treatment of it should be timely and thorough. The best obstetrical judgment should be exercised when there is reason to suspect a

protracted or difficult labor, especially since the application of forceps may in the individual case work quite as much harm to the head by trauma as it (the head) may receive in descending through a narrow, bony canal.

*Medical Treatment.* As soon as the cerebral damage is recognized, the treatment does not differ from that in use during the initial stages of apoplexy in the adult. The bowels should be freely opened with calomel. If there be an initial convulsion, a prompt effort should be made to control it with *sodium bromide*, gr. i to iii, every two hours, alone or together with *chloral hydrate*, if necessary, gr.  $\frac{1}{2}$  to gr. iii, per rectum, and repeated. Children tolerate both of these drugs well and in large doses, but it is especially desirable to give them per rectum. Chloroform inhalation is also indicated.

After the acute irritative symptoms are allayed, much remains to be done by way of keeping the affected parts in good tone, and supplying such environment and mental diversion as will prove least depressing in the prospective state of chronic invalidism.

*Orthopedic and Surgical Treatment.* The permanent motor disability calls for threefold consideration: (1) The care of existing deformities and contractures; (2) the prevention of further deformities and contracture; (3) the restoration of function as far as that is possible in the paralyzed group of muscles. Orthopedic devices are in many cases valuable, more especially when supplemented by gymnastics and a system of re-educational exercises for the muscle and co-ordinating power.

In the earlier years following the insult, persistent and patient efforts with local massage and passive movements for the affected limbs will be rewarded with far better results than at first seem possible. It is, I think, a grave mistake to predicate all cases of cerebral palsy as helpless, either from premises of future mentality or motility. Intelligent, painstaking and unceasing labor directed simultaneously at mind and body will make possible, even in the severer cases with gross lesions, the return of some acuity to the former and some function to the latter. In estimating repair and compensatory action, it is a fact worth mentioning here that the brain is capable of growth and development until puberty and even later. The splendid work achieved in some state and private institutions, that undertake to care for and especially train the feeble-minded and gross mental defectives, testifies to the possibilities in this direction.

The sensory defects, of which total blindness may be one, are incurable and unimprovable.

Cushing (*American Jour. of the Med. Sci.*, July, 1905) has advo-

cated operation as soon as the diagnosis of birth palsy can be made after the appearance of symptoms, and reports several cases in which he has successfully removed a large surface clot. Such a procedure is wholly justified if the diagnosis is clear and the operator a very skilled surgeon.

Starr has very logically and clearly discussed the feasibility of intracranial surgical interference in the later years following the insult, and rightly says that the criteria for operating are based upon two considerations: "(1) The pathology of the cases; (2) the results of operative experience." Placing his own experience with that of others, he believes the dangers are many. Cure is out of question, and very slight improvement in only a few cases can be expected. The intracranial surgery performed for such symptoms as athetosis and Jacksonian epilepsy is of too recent date to admit of conclusions. In not a few cases evidencing organic epilepsy, a well circumscribed lesion, such as an old hemorrhagic cyst, has been found. An attempt at surgical removal under such circumstances would seem justified. Sachs comments upon the successful inhibition of athetoid-choreic movements so common in these cases by the application of some simple form of restraint, such as a splint or plaster-of-paris bandage.

The postplegic rigidities, when marked, are amenable to correction by tenotomies and tendon transplantation, but to achieve good functional results requires quite as much careful neurologic study as surgical skill.

#### **Amaurotic Family Idiocy.**

*Synonyms: Arrested cerebral development; infantile cerebral degeneration; agenesis corticalis.*

A rare disease characterized by the gradual onset of paresis or paralysis, mental impairment leading to absolute idiocy, defective vision terminating in absolute blindness, marked marasmus and death invariably before the third year of life.

*Treatment.* No form of treatment has had the least effect in these cases. Since it is wholly untenable that the disease is of syphilitic origin, the routine administration of mercury and iodides is not justified, and need not be advised. Kingdon tried pituitary gland and cerebrine without effect. On the assumption that the disease may result from the elaboration of some toxin by the mother, Kingdon and Russel suggest that the children in the family be hand and not breast fed. In the presence of a hopeless disease this may prove worth while.

#### **Hydrocephalus.**

The term "hydrocephalus" denotes the excessive accumulation of serous fluid (cerebrospinal) either within the subarachnoid space or



the ventricles. The former is known as external and the latter as internal hydrocephalus.

Clinical forms aside, distention from increased intra-cranial fluid under pressure causes interference with vision in a considerable proportion of cases, evidenced by optic atrophy, bitemporal hemianopsia, nystagmus, and strabismus.

*Treatment.* It should be remembered that many cases of chronic hydrocephalus with small collections of fluid get well spontaneously, and such cures are often wrongly ascribed to indifferent remedies. *Prophylaxis* has no purpose whatsoever in the congenital type and in that form due to malformations neither prevention nor practice are of avail. The possible relations of syphilis and rickets suggest in the former the trial of specific measures, and in the latter remedies appropriate for a rachitic child. Taylor states that the application of mercurial ointment to the head seems to do more good than any other measure, but the very negative action of all medical measures does not much emphasize the value of this observation.

The general nutrition of the patient must be maintained by good food, fresh air, out-door life, and tonic measures for the blood and muscles, such as exercise and massage. Bandaging or strapping the head by means of medicated plasters has been practised now and then, but to no advantage. Resorption of the fluid with the aid of very active diuresis is attended with very negative results.

*Operative measures* contemplate (1) puncture of the lateral ventricles, through the fontanelle, a very ancient method; (2) obliteration of the ventricles, effecting anastomosis with the subdural space (Mikulicz, Watson-Cheyne-Sutherland, McArthur); (3) lumbar puncture. Of these, *lumbar puncture* is easily the best and safest procedure, though the rapid withdrawal of such fluid has several times been fatal. Forchheimer summarizes the surgical methods now in use as follows: "(1) Lumbar puncture may be used in any case; (2) as long as the circumference of the head is stationary none of the other methods should be contemplated; (3) when the circumference of the head increases rapidly and the condition of the patient becomes worse, operative procedure may be employed as a dernier ressort."

#### **Toxic Encephalopathies from Lead and Alcohol.**

Under this heading it is proposed to refer in brief to the treatment of the *cerebral* signs and symptoms of poisoning from lead and alcohol.

##### *Lead.*

The cerebral forms (occurring in perhaps five per cent. of the

cases of general lead poisoning), aside from being evidenced by headache, delirium, convulsions and coma, are attended by such grave symptoms on the part of the eye as transient or permanent blindness, oculo-motor paralyses and occasionally some lesser abnormalities.

The prophylaxis and well-known measures of use indicated in a case of lead poisoning require no extended mention here. Suffice it to say that adequate doses of opium for the pain, large draughts of saline purgatives for the constipation, small doses of iodide and copious water-drinking constitute the active remedies in the initial stage.

The *cerebral* symptoms require to be managed with much care and judgment, and only *moderately active catharsis* should be encouraged for fear of exhausting and weakening these patients. Diuresis, however, should be brisk and is best stimulated by copious water-drinking and large enemata (one to two quarts) of *normal saline* solution at warm temperature. Convulsions and delirium are best controlled with adequate doses of *bromide* and *hyoscin hydrobromate*, gr. 1-100. Opiates are undesirable, since they interfere with elimination.

Edsall comments upon the advantage of venesection and lumbar puncture where the need of cerebral decongestion is urgent in the severe cases.

### *Alcohol.*

The long-continued use or abuse of alcohol slowly and quite imperceptibly causes structural and functional changes in all the body tissues. The nervous system suffers markedly from the habitual over-indulgence and the visual apparatus as an integral part of the higher neuron centers gives evidence of its morbid susceptibility to alcohol in the development of *amblyopia*.

*Prophylaxis* embraces too many references to morals and is too much a matter of personal suasion to warrant more than mere mention. The correction of a habit that has grown to the proportions of a vice invariably requires more care and re-education than can be bestowed upon it in the home. Institutional treatment is productive of the best results in the average chronic alcoholic.

The step of first importance is the *withdrawal of alcohol*, and it is the consensus of opinion that in the majority of cases, in the presence of pronounced nervous phenomena, the withdrawal should be *gradual*, thus obviating collapse symptoms, and the possibility of delirium tremens. Vomiting is best treated by lavage, and the administration of remedies of use in acute and chronic gastritis. For sleep, the bromides, 5ss, repeated hourly for several doses, shortly before

bedtime; *veronal*, grs. iii to v, repeated, or *sulphonal*, grs. xxx, in hot milk, are useful. If the patient is robust and has good heart action, extreme restlessness and irritability are best controlled by tablets of *hyoscine hydrobromate*, gr. 1-200 to 1-100, repeated several times, at two or three hour intervals. Opiates and morphine are undesirable, tending to create new habits. Good nutritious food in plenty and out-door life do much to build up the patient.

#### **Brain Abscess.**

Abscess anywhere is primarily a subject for surgical discussion. Its occurrence in the brain is no exception in this conclusion, but its variable localization in the brain structure gives rise to focal symptoms, occasionally referable to the eye, such as hemianopsia, complete blindness, ptosis and conjugate deviation of the eyes, or head, or both. Brief reference to treatment is therefore justified.

*Prophylaxis.* Great importance attaches to proper asepsis in the treatment of all scalp wounds, infections and head injuries, adequate drainage of otitic and mastoid suppuration, careful attention to purulent nasal discharge, inquiry into possible infection of the accessory nasal sinuses, and the assurance of the best hygiene and sanitation for children convalescing from the acute infectious diseases, particularly scarlet fever, measles and pertussis.

*Palliation* as it applies to brain tumor and meningitis is hardly worthy of a trial, except for a special effort directed at the control of vomiting by the use of ice pellets taken by mouth or mustard poultices applied to the epigastrium, thus reducing the liability of the abscess to rupture.

*Surgical Treatment.* Starr has summed up the question of operative interference as follows: "The practical conclusion, therefore, which experience has taught, is this: That when a cerebral abscess seems probable from the history of the case and from the symptoms which have developed, and the general progress of the case demonstrates the existence of an increasing and serious focal disease of the brain, it is advisable to operate, even though the symptoms may not be absolutely typical and may present many variations from their usual form. As to the surgical prognosis, Macewen says: 'In uncomplicated abscess of the brain operated upon at a fairly early stage recovery ought to be the rule.'"

Whether the focal symptoms, referable to the visual tract or elsewhere in the brain, will be favorably influenced by operation, and to what extent, can only be determined by the factors governing each case, and may not be categorically stated.

**Brain Tumor.**

Aside from the interest that attaches to choked disc as a general symptom of brain tumor, and in less important degree to the anomalies of the visual field, the focal disturbances indicative of implication of the chiasm, pituitary body, third, fourth and sixth cranial nerves, quadrigeminum, occipital lobes and cerebellum are of immense significance to ophthalmologists. The medical and surgical therapeutic possibilities applied to so wide a range of symptoms require some detailed comment.

*Medical Treatment.* (a) *Casual.* If it is known or strongly suspected that the tumor is syphilitic, specific treatment becomes imperative and urgent. In brain tumor the *inunction* plan (*Schmierkur*) may be used and with good success, but if rapid mercurialization is desired to suppress fulminating signs and symptoms, the *deep intramuscular injections* are to be preferred. The symptoms of vesperal headache, somnolence and fleeting parlyses should yield in from two to four weeks after beginning the *Schmierkur* treatment (*vide Syphilis of the Nervous System*).

If after four to six weeks of vigorous treatment no improvement takes place, the idea of a syphilitic lesion should be abandoned.

*Potassium iodide* should always be adjunctive to this treatment, with the caution to give same in ascending doses until two hundred to three hundred grains, if necessary, are taken daily. There is a widespread preference among neurologists for the saturated solution in increasing drop doses, but when badly borne, *iodonucleoid* or *iodalbin* may be substituted (*vide syphilis*). Massive doses of iodide, except in rare instances, need not cause gastric distress if sufficiently diluted. I frequently give the full daily dose of three hundred to four hundred grains in a quart of milk (if so great a dilution is necessary), and let the patient drink of it at intervals, so long as he gets the quantity prescribed for the twenty-four hours. Ordinarily, it may be taken either before or after meals.

Particular care of the mouth and teeth will prevent salivation:  $\mathcal{R}$ : *Pulv. potassi chloratis*,  $\mathfrak{z}\text{ii}$ ; *Ol. cinnamon*, *m. x.*, rubbed up well, with directions to use same as a tooth powder after meals, will assist in keeping the teeth and gums in good condition.

The routine use of mercury and iodides in non-syphilitic tumors is to be deprecated because it is useless, although some instances of "apparent" improvement have followed its administration.

*Symptomatic Treatment.* 1. Headache. The coal tars, such as phenacetine, acetanilid, and antipyrine, in liberal doses, ten to twenty grains at a time, will relieve; *pyramidon* in five grain doses

does good, but for intractable severe cephalalgia I have found nothing to equal *codeine* by mouth in one grain doses, often repeated, and later *morphine*, also in large doses, since small ones never suffice. If the growth is inoperable, then one's conscience need not trouble about developing in the patient a habit for morphine or opium. Ice-bags or hot fomentations to the head may afford some relief. 2. Vomiting, when not controlled by ice pellets taken internally, counter-irritation to the epigastrium, or sodium bromide in large doses, is only relieved by *morphine*. 3. Sleeplessness. Long-continued warm baths may be tried, and the hypnotics, veronal, isopral, trional, sulphonal, paraldehyde, chloralamid, and finally opiates should be given. 4. Convulsions (epileptiform) may yield to massive doses of *bromides*, but not for long. 5. Apoplectic attacks and paralyses must be treated symptomatically as they occur. 6. Optic neuritis: *Strychnin nitrate*, gr. 1-30 to gr. 1-15, hypodermically, has given temporary improvement and similar betterment in vision has followed the use of potassium iodide.

*Surgical Treatment.* During the past ten years neural and intracranial surgery has received a decided and widespread impetus, chiefly through the efforts directed at the operative removal of brain tumors. The question of operability and the choice of operation is not the least interesting of the issues appearing in the full and extensive literature on the surgical aspects of tumors. In following the more recent neuro-surgical contributions of Horsley, Mills, Spiller, Cushing, Frazier, and others, one cannot help but feel that immense and probably enduring good will come of their investigations and operative results. Controversy is still rife, perhaps too much so, to admit of any kind of postulation suitable or essential to the purposes of a text-book, nevertheless generalizations of practical importance have been adduced and may, I think, be properly stated here. However, in placing any estimate upon the brain surgery done in the past few years and the surgical attitude resulting therefrom, the important fact should always be borne in mind that operations of such statistical value were performed by the most highly specialized surgeons, with most resourceful aids of diagnosis at hand, and under premises most favorable for a small mortality. To hope to maintain such standardized achievement, suspected brain tumors should come for neurologic diagnosis and surgical intervention only to those best qualified to give an opinion and render the service.

In the event of advising operation for brain tumor, it is well to painstakingly explain to the patient or his relatives that an exploratory operation only is contemplated; that under favorable auspices its re-

removal will be undertaken, which may result in saving of life, not, however, without some permanent disabilities; that failure may attend the effort because of the nature, inaccessibility, and deep position of the tumor.

Surgical details of operation are not required in this discussion.

*Radical Operation.* The cases in which intracranial tumor can be completely and successfully removed (cured) by operation are rare. The prospect for radical enucleation with recovery is not very encouraging. A successful operation depends upon (1) the situation of the tumor; (2) its removal early in the course of the disease; (3) variety of tumor found; (4) the amount of brain tissue destroyed either by the tumor or in the course of the operation (Starr).

1. Tumors arising and located on the lateral aspect of the cerebral hemisphere are the most accessible, therefore the most operable and promising of success. Meningeal growths afford the best results; cortical the next best, especially of the motor and occipital zones. A number of tumors have been successfully removed from the frontal, parietal and occipital areas. Cerebellar growths are very difficult of access, only a small part of each lobe being accessible through the occipital bone, and yet in 116 operations for this type, the mortality, once 70 per cent., is now 38 per cent. (Frazier, 1905).

2. In regard to the desirability of early surgical interference, a critical survey of the literature shows that many patients have been sacrificed by unnecessary delay. *As soon as an accessible tumor, syphilitic growths excepted, can be diagnosed with certainty, an operation should be decided upon without delay.* It is a waste of valuable time to administer medical or routine specific treatment in this class of cases. 3. The pathologic variety of tumor and its amenability to successful removal is to be best inferred from the accompanying table, borrowed from M. Allen Starr. From this it will be seen that carcinomata, gliomata and multiple tuberculosis are the least favorable for operation, whereas sarcomata, cysts and solitary tubercles are the most favorable.

TABLE OF VARIETY OF TUMOR REMOVED AND RESULT.

Variety.	Recovered.	Died.
Sarcoma .....	52	20
Gliosarcoma .....	10	0
Cyst .....	29	11
Angioma .....	7	1
Gumma .....	8	3
Tubercular .....	19	8
Fibroma .....	7	2
Endothelioma .....	5	4
Glioma .....	15	13



A most instructive tabulation of 828 operated brain tumors, published by Philip Coombes Knapp (*Boston Med. and Surg. Jour.*, Feb. 1, 1906), is deserving of citation and careful analysis.

RESULT IN OPERATIONS FOR TUMORS OF THE BRAIN.

	Re- covered.	Im- proved.	Not Imp'v'd.	Died.	Result not Stated.	Total.
Removed . . . . .	112	122	78	123	36	471
Not found . . . . .	4	24	61	87	13	189
Impossible . . . . .	0	11	11	40	2	64
Palliative . . . . .	0	48	36	15	5	104
Total . . . . .	116	205	186	265	56	828
Frontal . . . . .	15	6	3	8	2	34
Central . . . . .	52	82	43	54	5	236
Parietal . . . . .	7	5	5	12	0	29
Temp. . . . .	2	4	6	5	1	18
Occip. . . . .	3	3	2	2	1	11
Cerebellum . . . . .	7	16	8	23	1	55
Not stated . . . . .	26	6	11	19	26	88

Spiller thinks no attempt should be made to remove a glioma, and deprecates partial removal in general.

*Palliative Operation.* From a very careful inquiry into the literature and an extensive personal experience, Spiller and Frazier (*Jour. Amer. Med. Assoc.*, Sept., 1905) conclude that surgical palliation in cases of cerebral tumor is justifiable. To this end the operation of *cerebral decompression* has been many times performed and described, chiefly by Cushing and Frazier. The principal symptoms calling for relief are headache, nausea and vomiting, and threatening blindness. Particular stress is put upon the fact that the palliation improves or saves what eyesight the patient may have, therefore the insistence to *operate early before the optic neuritis has become intense*. All observers are impressed with the rapid subsidence of choked disc immediately upon opening the skull, irrespective of an intact or open dura. The *preservation of eyesight and the decided relief from severe headache has been uniformly good*. Palliative operations should in no sense be regarded as a substitute for radical measures and the growth should always be removed when possible by a competent operator. Spiller emphasizes the point that "palliative operations should be performed early in every case in which symptoms of brain tumor are pronounced, and before neuritis has advanced far especially when syphilis is improbable or antisiphilitic treatment has been employed."

**Paralysis of the Facial Nerve.**

The seventh cranial nerve is the motor nerve of the face, al-

though some sensory and secretory filaments join in its course. A lesion in its peripheral (infranuclear) portion, in most instances of neuritic origin from exposure to cold, and called Bell's palsy, results in a paralysis of all parts of the affected half of the face, leaving it immobile, with inability to close the eye or elevate the brow. In paralysis of central (supranuclear) origin oral deflection is present, but the oculofacial muscles escape entirely or are but slightly affected.

The paralysis of the orbicularis palpebrarum, the effects of undue exposure of the eyeball and excessive lachrymation lend special significance to facial paralysis for the ophthalmologist.

*Treatment.* In the rheumatic or neuritic forms (Bell's type) the paralysis is present and complete before any causal or abortive therapy can be thought of, much less applied. The damage has been done and subsequently requires symptomatic treatment.

When pharyngeal or parotid gland inflammations, middle ear or mastoid disease are known to exist, careful attention to these will reduce the liability to facial paralysis. Basal fractures and injuries to the nerve at its foraminal exit from blows, falls, or the obstetrical forceps, require surgical service.

It is a fact, but one not sufficiently known or appreciated, that a considerable number of iacial paralyses get well without any form of treatment. Assuming a rheumatic basis upon which some cases are supposed to rest, a brisk saline purge, followed by the administration of salicylates and alkaline beverages for some days, seems rational. Locally, to the affected side of the face, an alternating fine spray (or douche) of hot and cold water under some pressure will stimulate capillary circulation and thereby improve the tone of flaccid muscles. Gentle friction may be made an adjuvant to this measure, but massage by an experienced person should be reserved for the subacute and chronic stage when repair sets in. If counter-irritation is used at all, it should be by blisters or leeches applied not to the face, but to the nerve trunk in the region of the stylomastoid foramen.

Since the facial distortion is intensified with every effort at eating, smiling or talking, it should be the aim of the patient to keep the features as passive as possible, constantly correcting the exaggerated position of the cheek and mouth after eating, drawing the eyelid down to cover the eyeball, and wearing a light compression pad to ensure closure of the eye during the night and when out in dusty or inclement weather. Conjunctivitis and corneal ulcerations are not so likely to develop in an eye relatively well protected.

Immediately after the onset of paralysis, the muscles should be subjected for five minutes and less each day to the *galvanic current*,

the anode being placed over the motor points of the affected side of the face, and gentle contractions made by anodal closure. It is well to discontinue electrical treatment after six months, for the reason that the severer type of cases, lasting beyond this time, show a tendency to develop contractures under long-continued stimulation. *Strychnine*, in doses of gr. 1-60 to 1-30, three times daily by mouth, for a continuous period is of service as a general tonic.

In two classes of cases *surgical interference* is indicated and seems desirable: (1) The congenital, which after an interval of two years show little if any improvement, and (2) the chronic, which after one and a half to two years remain stationary. The operations contemplate an anastomosis of the facial with the hypoglossal or the facial with the spinal accessory. Spiller favors the former and Cushing thinks well of the spino-facial operation. The respective merits of these surgical procedures requires no extended mention here.

#### **Facial Spasm.**

Importance attaches to a clinical form of facial spasm limited to the muscles about the eye, and called blepharospasm. In the majority of cases sensory irritation in the course of the trigeminal nerve is a cause which should be sought after and removed, if possible.

*Treatment.* Antispasmodics are valueless, but arsenic has occasionally done good. Electricity is of no use. Local refrigeration of the cheek by the ethyl chloride spray (Weir Mitchell) has been tried. Stretching of the facial nerve may result in temporary facial paralysis and subsidence of the spasms, but ultimately twitching reappears. In the past year the French literature has brought a reference (Baudoin and Levy: *Rev. Neurol.*, Paris, p. 779, 1908) relative to the cure of genuine facial spasm of severe type by means of *alcohol* (ten to twenty minims of 75 per cent. strength), injected into the facial nerve trunk just back of the ear at its point of exit from the stylomastoid foramen. The spasm was promptly replaced by a well marked facial paralysis of the peripheral type, which in due course of time (a year) disappeared. *The spasm did not recur.* I have in the past year seen one case of severe facial spasm so treated and with marked success (Patrick: *Jour. Nerv. and Ment. Dis.*, 1908). This technically insignificant procedure opens up for discussion the broad question of the propriety of substituting a paralysis (though not permanent) for a spasm.

#### **Neuralgia of the Fifth Nerve.**

*Trigeminal or Trifacial Neuralgia; Tic Douloureux; Prosopalgia.*

Of the many local clinical varieties of neuralgia the most frequent and by far the most severe is that of the fifth or trigeminal nerve, the

largest and most important nerve of common sensation in the body. It is not intended here to define or even outline with detail the entire course of the trigeminal. Suffice it to say that sharply localized or radiating pain referable to the eyeball or orbit in this disease arises chiefly in the course of the supraorbital branch of the first ophthalmic division or the infraorbital branch of the second superior maxillary division of this nerve. Intense interest will continue to be felt in tic douloureux so long as the pathogenesis remains obscure and the agonizing pain eludes our complete and permanent control.

*Treatment.* Experience with patients suffering from neuralgia of any kind or in any location, quickly leads to the conviction that relief from pain is usually the first and urgent need, although search for and removal of the cause (if possible) is a service of more intrinsic value. In the zeal to control pain, *causal factors of minor facial neuralgias* are apt to be slighted, entirely overlooked or misinterpreted. The teeth, for instance, should receive careful examination and, caries aside, an impacted wisdom tooth, when suspected, should with the help of an X-ray picture not escape detection. Riggs' disease (dental exostosis) is a greatly overestimated cause of neuralgia. The mere possibility of a dental source of aggravation should not lead to the purposeless extraction of nearly all the sound teeth a patient may possess, a fearful penalty to pay without in the least influencing the severe type of trifacial pain. The infections of the accessory nasal sinuses and the antrum of Highmore are *occasionally* factors in producing neuralgic pains, and when properly treated cause the latter to subside, but sinus enthusiasm among some rhinologists has made possible the correlation of every trigeminal pain with sinus infection, an inference not at all warranted if our positive experience with gasserectomy is to count for anything in determining the ganglion as the pathogenetic source of trifacial neuralgia.

Local irritation from the mouth, nasopharynx, middle ear complications, ocular disease (iritis, glaucoma), and inflammatory foci at a distance capable of producing neuralgic pain must be sought after and intelligently treated as they deserve. *Refractive errors* of the eye are, according to most observers, not a source of neuralgic pain except in psychoneurotic individuals. It is of the utmost importance to apprehend as a common source of minor neuralgic pain the general systemic condition of a patient suffering from malaria, influenza, lues, anemia, the drug toxemias and intestinal autointoxication, and in each instance outline the proper treatment. Neuralgic pains about the face secondary to general disease, such as diabetes and rheumatism, call for

the treatment of the underlying disease. Other prolific sources as hysteria and neurasthenia, require the treatment of these conditions.

The numerous measures from time to time adopted to prevail against the *pain* of trifacial neuralgia include an array of diverse anti-neuralgic drugs, methods of counter-irritation, nerve stretching, deep infiltrating (nerve deadening) injections, peripheral nerve resection, and in the last analysis, gasserectomy.

Sedatives, having less value than anodynes or antineuralgics in the presence of severe pain, neither bromides nor valerian are of much service in this affection. They only suffice to control nervous irritability. Aconite and gelsemium are said to have a selective action on the fifth nerve. The tincture of aconite, gtts. v-xv, or the fluid extract (m. i-ii) may be given for several doses at intervals of one hour each. Starr prefers aconite and calls it the best remedy. The *fluid extract of gelsemium* (m. ii-iv.), increasing same by one drop each time, may be safely given in moderately severe cases, every three to six hours, until the physiologic effect (heaviness of the upper eyelids) is produced. The fluid extract is to be preferred to the tincture or other preparations, although Horsley contends that tincture gelsemium, 5i, given every two hours, is very effective when pushed to produce toxic symptoms, "a feeling of sickness with numbness in the extremities of the fingers."

I have used for the relief of the pain in many mild early cases, the following combination with good success:

℞

Ext. gelsemii fld.,	gtts. i-ii
Ac. arsenosi,	gr. 1/100-1/30
Antipyrini,	gr. iii-vi
Caff. citratis,	gr. ss-i
Ft. Caps. d. tal. dos. No. 1.	

Sig: One capsule, to be repeated every two or three hours for three doses, with a full glass of water.

*Extract cannabis indica* (gr. 1/4-i) is of value. Arsenical preparations (acidi arsenosi, liq. pot. arsenitis) have been used, and latterly *sodium cacodylate*, gr. 1/8 to 1/4, has found favor in the anemic and malnutritional cases, while quinine has been used as an alternative in the non-malarial and as a specific in the malarial types. Dana's advocacy of stychnia hypodermically in increasing to massive doses of gr. 1/50 to gr. 1/5 once daily has received a thorough trial, with, however, somewhat indifferent results. The coal tar products, headed by *antipyrin*, have a marked palliative effect on the pain, even in the

severer and chronic cases, but must be given in larger doses and oftener than ordinarily (gr. v-xv every two or three hours) to be serviceable. Acetanilid, gr. v, or phenacetine, gr. x, or salipyrine, gr. xv, or salophen, gr. xv, combined with caffeine citratis, gr. ii, in each instance given to avoid any depressant action on the heart, is indicated. Of other palliatives, *butyl chloral hydrate*, gr. v, every hour for four doses, has been highly recommended.

Where arteriosclerosis is a factor, nitroglycerine, gr. 1/100 to gr. 1/50, or *nitrite of sodium*, gr. ss to i, are of service.

When most remedies fail to relieve, then opium or morphine must be advised, and this is what eventually happens in the majority of the cases. Krause forbids it absolutely because of its habit phase; but interdiction of this sort is hardly tenable in the presence of an imperative necessity for relief during paroxysms.

In every case of trigeminal neuralgia the general supportive treatment, consisting of full diet—milk, eggs, cod liver oil, beef marrow, tonics, is important. The rest-cure treatment with massage and hydrotherapy may prove necessary.

*Castor oil* given nightly in  $\bar{5}$ ss to  $\bar{5}$ i has been recommended and has proven serviceable in controlling pain in a number of cases. Its beneficial action, when the laxative effect has worn off, is thought to be due to its nutritive and food values and is therefore of service in anemic and poorly nourished individuals.

Change of climate should be advised whenever there is provocation, and especially if palliation is disappointing.

*Local Measures.* Blisters and the actual cautery to the "tender points" on the face diminish pain, but incur facial blemishes. The ethyl chloride spray refrigerates the skin and gives better temporary relief. Liniments, lotions and salves have a very transient effect, but may be tried.

Electro-therapy, on the whole fails to accomplish anything, although galvanism (weak) in early cases is recommended.

*Intra- or Perineural Injections.* 1. A few drops of cocaine solution ( $\frac{1}{2}$  to 4 per cent.) injected into the foraminal exits of the supra- and infraorbital branches on the face gives prompt but only transient relief. 2. Osmic acid (1 per cent. in glycerine and water) (Bennett; Murphy) injected in like manner as cocaine, with a view to destroying the pathological sensory irritability of the nerve, is a method now quite obsolete. 3. *Alcohol* (2 c. c. in ascending strengths, 70 to 90 per cent.), has been injected into the large divisions of the fifth nerve at their basal exits from the skull, the foramina ovale and rotundum and, for the first division, the orbit (method of Levy and



Baudouin). I have been able to observe the results in twenty-two of my own cases in which I have given a total of sixty-two injections by this method, and am satisfied of its *great palliative merits*. The chance for cure in a permanent sense from a single injection is not good, but complete cessation of pain for a period of from two to ten months results from one or more injections. (Levy and Baudouin, Schloesser, Ostwald, Patrick, Killiani, Hecht, Bodine and Keeler.)

With gasserectomy expedient only in desperate cases as a last resort, deep alcoholic injections are deserving of much consideration and attended with successful and prolonged palliation.

*Surgical treatment.* To be considered are section and resection of the peripheral nerve trunks, nerve stretching, divulsion, extirpation of the Gasserian ganglion, division of the sensory root of the fifth nerve above the ganglion (Spiller, Frazier).

Gasserectomy is to be suggested as the final intervention, with the prospect of a cure, but the gravity of the operation gives rise to hesitancy on the part of the patient, and the surgical difficulties encountered cause most operators to be diffident in this undertaking.

#### **Ophthalmoplegia.**

An acute or slowly progressive chronic paralysis of the internal or external eye muscles, or both, following a variety of causes, such as syphilis, lead, alcohol, toxemias and the acute infectious diseases, and due to lesions involving the nuclei or roots of the third, fourth and sixth (oculomotor) cranial nerves.

*Treatment.* When the onset is sudden, with pronounced cerebral symptoms, such as vomiting, headache, vertigo, delirium and coma, the ice-bag to the nape of the neck and antipyretics may be used. Leeches to the temples are recommended by the German writers.

Active catharsis and diuresis is essential from the very beginning of the attack. Diaphoresis to the point of profuse sweating is to be encouraged by the giving of daily hot baths and packs, or the hypodermatic use in graduated doses of pilocarpine muriate (gr. i—5i of water), injecting of this solution 2 minims and increasing by one minim daily until sweating is profuse. The patient while receiving these injections and for six hours thereafter should remain quiet and well covered in bed. Care should be taken to protect the eyes and afford them rest.

In the chronic cases treatment is usually futile. In the syphilitic cases, specific treatment should be freely used (*vide* Syphilis of the Nervous System). Cardio-vascular conditions are to be met with nitrites and strychnine given in small doses over long periods of time. Late in the disease *strychnine nitrate*, given hypodermically in doses

of gr. 1/60 to 1/15, once daily, is said to be of distinct value in stimulating the nerves, but ophthalmologists are in the better position to answer on this point. The operative treatment of ptosis is also reserved for the eye specialist.

#### **Bulbar and Pseudobulbar Diseases.**

When a *primarily* degenerative lesion, whatever its cause, is located in any part of the cerebral axis, it gives rise to a combination of symptoms referable to the cranial nuclei involved in the compass of that lesion. The great functional importance of the medulla oblongata, in whose substance reside the nuclei of glossopharyngeal, hypoglossal, vagus and spinal accessory nerves, has led to a somewhat elaborate clinical classification of the disease processes affecting it. It will be adhered to in this brief consideration of treatment.

#### **Chronic Progressive Bulbar Paralysis (Labio-glosso-laryngeal paralysis).**

A disease of chronic and progressive type, characterized by paralysis involving the lips, tongue, throat and often the larynx, and more rarely the motor parts of the trigeminus, facial and ocular nerves.

*Treatment.* No form of treatment can appreciably influence the course of this disease, which is commonly fatal within three years after onset. Neither syphilis nor alcohol has any direct bearing on this malady, consequently specific treatment is not indicated.

Hypodermatic injections of strychnine in increasing doses from gr. 1/60 to gr. 1/10, as given in progressive muscular atrophy, may be tried, but will be found disappointing.

Efforts, therefore, must be directed at the *physical comfort* of the patient. *Diet* of the proper sort, especially in the latter stages, is of great importance. Food of good quality should be given in liquid or semi-solid form, consistent with the difficulty in swallowing, and when aspiration symptoms threaten, stomach tube feeding becomes a necessity. Large quantities of milk, eggs and broth may be taken in this manner for months at a time. Nutrient enemata are also indicated.

Electricity has been recommended, especially by Remak and Kussmaul (galvanic current with anode placed at nape of neck and cathode applied over muscles at either side of trachea), but is of doubtful value.

When aggravating symptoms of coughing, dyspnea, syncope and drooling arise, they require special treatment. Forchheimer says of the use of atropine, grs. 1/130 quite commonly administered to check saliva, that the drooling of paralytics is not controlled by it, and adds,

"the drooling is largely due not to increased flow of saliva, but to the impossibility of swallowing the normal amount secreted."

Bromides improve the dyspnea at first, and in the later stages tracheotomy may become imperative. Coughing cannot be controlled by ordinary sedatives, and only the utmost care in breathing and swallowing can prevent it. General tonics, strychnine, arsenic and the hypophosphites, an out-door life, and other measures to improve hygiene are useful.

#### **Acute (Apoplectiform) Bulbar Paralysis.**

(Hemorrhage, Embolism, Thrombosis of the Arteries of Bulb and Pons.)

An affection of the medulla and pons mainly of vascular origin, acute in onset, and immediately fatal, or, as the underlying vascular pathology would suggest, capable of improvement with more or less permanent defect.

*Treatment.* The prophylaxis and treatment of the acute stage cited under arteriosclerosis and apoplexy is here indicated. In young individuals syphilis is to be thought of as a possible cause, and energetic specific treatment instituted. As in chronic progressive palsy, the difficulties in swallowing and respiratory embarrassment must be guarded against by proper diet. Nothing is to be gained by use of strong drugs.

#### **Pseudobulbar Paralysis.**

An affection characterized by the symptoms of bulbar disease, in which, however, the underlying pathological changes occur not in the medulla oblongata, but in the cerebral hemispheres. Associated with the bulbar symptoms there may be aphasia, progressive mental impairment, hemianopsia, and various paralyses of the extremities. Optic atrophy or neuritis may occur as one of the less constant findings.

*Treatment.* This disease, although characterized by frequent remissions, is progressive and ultimately fatal, and treatment is discouraging. The advice previously given in the matter of feeding, hygiene and tonics is pertinent here.

#### **Myasthenia Gravis.**

*Symptoms:* Asthenic bulbar paralysis (Strümpell); bulbar paralysis, without discoverable anatomical lesion; myasthenia gravis pseudo-paralytica (Solly).

A disease of gradual and insidious onset, characterized primarily by extreme general exhaustion following the slightest exertion,

and in about one-half the cases associated with symmetrical ocular palsies, chiefly giving rise to double ptosis.

*Treatment.* The chief concern in the treatment of this disease should be the evidence of fatigue from muscular exertion of any kind. Absolute rest is most desirable even in the cases of moderate severity. Patients should be advised to do little or no talking, and submit to being slowly fed, in order to conserve muscular strength and energy. Liquid or semi-solid food is to be preferred, as it reduces the effort of swallowing. The use of stimulating degrees of electricity to the muscles, is according to Oppenheim, absolutely dangerous and to be deprecated. Central galvanization has been advised by some, who claim to have found it useful.

I have observed the action of daily increasing doses of strychnine hypodermically given, and found it of little or no value, except when the patient was receiving at the same time an almost complete rest cure. Fatigue of the upper lids (ptosis) is best overcome by placing a bandage over the eyes for some minutes at a time.

## CHAPTER XVII.

### TREATMENT OF THE MORE IMPORTANT DISEASES OF THE NERVOUS SYSTEM THAT AFFECT THE EYE.—CONTINUED.

*Syphilis of the Nervous System—The Parasyphilitic Diseases—Tubes Dorsalis and General Paresis—Multiple Sclerosis—Friedreich's Ataxia—Syringomyelia—Multiple Neuritis.*

#### **Syphilis of the General Nervous System.**

Syphilis of the general nervous system means the effect of an active syphilitic virus upon nerve structure and not the late primary degenerative change that follows the elaboration of some toxin by the specific virus.

Specific lesions of the nervous system are presumably microbic in origin and essentially neoplastic in type; that is, they originate as simple inflammations, gummy excrescences or tumor masses (syphilomata) in the connective tissue or blood vessels, and, secondarily, invade the parenchyma, disturbing function and then destroying it through local tissue death. Just what determines whether the nervous system is destined to become involved, and which part of it, we have no way of knowing, but the explanation is at hand that there may be in certain individuals (1) a special affinity of the virus for nerve tissue, or (2) a lessened resistance of nerve structure toward the virus.

Since any part of the central nervous system is liable to luetic infection of interstitial or vascular origin, it is evident that a great variety of lesions can occur, giving rise to many different types and groups of symptoms. The diagnosis of these, when widespread and varying, is not always easy, but certain of the signs and symptoms by appearing in bolder relief than the rest are strongly suggestive of a luetic process, and not the least of these are the ocular manifestations. Syphilitic basilar meningitis extensively involves the *optic*, *oculomotor* and *abducens* nerves in the region of the chiasm. Wherever the lesion, whether in its secondary or tertiary stage, and whatever its symptoms, the round-celled infiltration and gummatous nature calls for anti-syphilitic treatment, which in the majority of instances can be relied upon to act with good effect.

*Prophylaxis.* Positive prophylaxis against syphilis of the nervous system must be taken to mean the accomplishment of an ideal prophylaxis against primary syphilis with the aid in one form or an-

other of an antisymphilitic vaccine. Whereas this seems far from realization, yet the experiments of Metchnikoff and Roux, the more recent discovery of the spirocheta pallida by Schaudinn, and the efforts at sero-diagnosis by Wasserman, should tend to encourage promising investigations in this direction.

The initial lesion once acquired, the question arises, Will a prompt and efficient and even intensive course of specific treatment be of avail in preventing dire consequences to the nervous system? That it will in the majority of cases none may doubt, since it has been estimated from large statistics that when properly treated 90 per cent. of the cases get well and remain so. It is the physician's duty, in the presence of syphilis, to keep the patient's resistance continually at the highest point, and all measures that will reinforce him physically, mentally and morally should be invoked. Interdict alcohol and regulate venery and reduce tobacco. Encourage a diet that will increase bodily strength and weight. The mouth, gums and teeth should be well cared for and frequently inspected by a dentist, who will limit infection and decay. The nasopharynx should also receive attention.

*Medical Treatment.* When cerebral syphilis develops, *anti-specific treatment should be immediately and energetically instituted.* Nothing short of a vigorous, intensive treatment should be contemplated. When it is desired to get quick and complete control of a syphilitic condition, initiated, for instance, by a single convulsive (epileptic) seizure, the inunction treatment may well be waived in behalf of the more accurate and rapid administration of mercury by *deep intramuscular injection*. Prompt use of mercury by this method is to be recommended at *critical* periods in the disease. When it is intended to establish foci of mercury in the deep muscular tissues from which slow resorption takes place, the *insoluble preparations*, such as

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(Mention of the work of Metchnikoff and Roux with calomel ointment seems in place here, because the investigators are trustworthy and reliable, the remedy they advocate simple, its application easy, and the protection it affords against primary infection is said to be sufficiently ample to justify its widest use. Calomel ointment (calomel, 1 part, to lanolin, 3 parts) is rubbed into the genitalia, the penis, chiefly the prepuce and glans, for about five minutes immediately after suspicious intercourse, or within one hour thereafter, or, better still, it may be used as a lubricant to the parts during coitus. The authors remark that the remedy offers protection against digital infection and is therefore of great service to physicians, surgeons, nurses and midwives. Neisser, whose results with the ointment were not always favorable, concludes that the chance for error in the experiments is too great to admit of dogmatic generalization, adding that Metchnikoff's convincing data might be due to a more superficial kind of inoculation. Suffice it to say, however, that calomel ointment with proper instructions for its use, has been issued by the Under Secretary of State for War in France, to the army, as a prophylactic measure against venereal disease.)



calomel and the salicylate of mercury suspended in sterile oil and lanolin are used, gr.  $\frac{1}{2}$  to  $1\frac{1}{2}$  Hg. to 1 c.c. of oil, injected every four to six days.

Gottheil (*Progressive Medicine*, 1903, p. 177), who is the most ardent advocate of their use in this country, employs a ten per cent. suspension of mercury salicylate in sterile liquid albolene ( $1/10$  gr. to 1 min.). Of this he injects 8 to 15 minims at intervals varying from seven days to three weeks, depending upon the progress of the disease and condition of the patient. Using the syringe and needle preferred by Gottheil, the insoluble oil is injected into the buttocks, in the inter-trochanteric space, observing due care not to puncture a vein or engage the needle point in a vessel. This method is free from harm and pain, and of greater convenience to the patient because of longer periods intervening between injections.

The *soluble preparations*, such as corrosive sublimate and peptonate of mercury, are rapidly absorbed with little or no local irritation. In my own experience corrosive sublimate in normal salt solution, gr.  $1/12$  to  $1/6$  to 1 c. c. solution, injected every second or third day, has been most satisfactory. The gluteal muscle masses, the lumbar muscles or occasionally the intrascapular cellular tissues are chosen as the site for injection. Soreness that may follow is only transitory. The danger of thrombosis or embolism by penetrating a vessel is not great in these regions, but the remote possibility of so serious an accident should lead to great precaution in the technic, which it is needless to add, includes rigid asepsis.

*Inunction* (endermic method). Extremely urgent instances aside, the inunction method, Schmierkur, of the Germans, has, on the whole, given the best satisfaction in nerve syphilis. It may be inferior to the oral or hypodermic method in point of rapidity and cleanliness, but it fulfills most of the demands made upon it in most of the cases and is often less prone to produce salivation and obviates the gastro-intestinal disturbances. The *unguentum hydrargyrum* (50 per cent. Hg.), dispensed in exact dosage in wax papers, is used, or the more elegant Vasogen preparation (25 to 33 per cent. Hg.) may be preferred. Where it is desired to suppress facts surrounding a case of lues in infancy, anti-specifics in agreeable disguise may be given. Colloid calomel (calomelol) a grayish powder, 75 per cent. calomel and 25 per cent. albuminoids lends itself well for this purpose. It is used in the form of calomelol salve or "Unguentum Heyden" which has an additional 2 per cent. of free mercury (*Abt. Ill. Med. Jour.*, April, 1907).

The treatment should be systematic, with written instructions to

the patient. It has been my custom to prescribe unguentum hydrargyri, ʒss to ʒi, to be rubbed in nightly by the patients themselves. One thorough rubbing on a different non-hairy surface (flexor) each night for five nights, a warm cleansing bath on the sixth, a rest on the seventh, and a second series of five rubbings on successive nights, with interruptions of bath and rest as before. From four to eight such series are usually required. If the patient from force of habit finds daily bathing indispensable, there is no objection to taking a short cleansing bath in the morning. Some authors advise that the site of inunction should be previously cleansed with soap and warm water and then alcohol or ether, the better to prepare the surface for ready absorption, and further suggest the application of a tight flannel bandage over the part rubbed.

If at the end of thirty rubbings improvement is not noticeable or notable, they are to be discontinued. It is relevant to add, however, that some individuals have non-absorbing skins, on which no amount of rubbing will do good. That being the case, no time should be lost in resorting to deep hypodermic medication.

*Oral Administration.* The vast majority of syphilitic cases in this country are treated by mouth, perhaps because it is convenient and favors concealment of the patient's disease. This method, with its tendency to produce gastro-intestinal disturbance, stomatitis and diarrhea, is not free from serious objections, and in neurologic practice has found little or no favor.

If inunctions are not effective and hypodermic medication undesirable, the protiodide, gr. 1/8 to 1/3, three times daily, after meals, may be given, or the *hydrargyrum tannicum oxydulatum* (Lustgarten), gr. ii to v, after meals, in pill form, which is said to contain 50 per cent. mercury, easily assimilable and non-irritant, non-salivating and less diarrheal in its effect.

*Intravenous injections* of mercury have been advocated of recent years, especially when coma is present, together with other symptoms of gravity, but the risk of the thrombosis and embolism, in my opinion, outweighs all considerations in its favor. I have not yet availed myself of this maneuver, nor do I feel disposed to recommend it to others until more convinced of its superiority over other measures.

Mercury in any of its forms and under any premises will surely do harm if given injudiciously, meaning in doses either too large or too continuously. The dangers of chronic mercurialism need no reference here.

The care of the teeth, gums and mouth is most essential whenever mercury is exhibited in any of its forms, and either a tooth

powder or gargle, or both, should be in frequent use three times daily after eating, to preserve oral cleanliness and prevent stomatitis. Among the most serviceable I have found the following:

℞	
Pulv. pot. chloratis	ʒii
Ol. cinnamoni	m. x
Ft. Rub up well.	
Sig: Use as a tooth powder.	
℞	
Potassi chloratis	5.00
Mel. desp.	
Tr. myrrh āā	15.00
Aqua dist.	200.00
Sig: Use as a mouth wash.	

In treating syphilis of the nervous system the *iodides* are administered conjointly with the mercury, but it is the experience of not a few neurologists to ascribe their good results to the use of mercury and not iodides. This, however, is not equivalent to saying that the iodides do no good. It is a good plan, too, when intensive doses of mercurial alone are being given, to stop short and continue with iodides for a month and then return to mercury. Especially when patients show undue tolerance for either mercury or iodide, impairing their specific value, the alternating type of therapy is to be commended. Neurologists in this country advocate iodides in *massive* doses, while on the Continent small doses are the rule. Potassium iodide, the saturated solution (15 to 100 drops) three times daily, is to be given after meals, well diluted in water, Vichy or Seltzer, or milk.

Iodism is best prevented by the large dilution, and a daily dose of 300 to 400 grains in a quart of milk or aerated water, to be taken in divided doses during the twenty-four hours, will obviate gastric distress and other ill effects.

A preference is shown by some for *sodium iodide* because it is said to contain more iodine and is less irritant to the stomach and less prone to produce iodism. *Iodonucleoid*, a preparation containing 23 per cent. iodine, is a pharmaceutical refinement of iodide possessed of great merit, and may at any time be given in a dosage from 5 to 20 and even 60 grains three times daily, for a long period of time, without giving rise, except in very rare instances, to gastric distress or other familiar signs of iodism. I have given it repeatedly in doses of 60 to 100 grains three or four times daily without ill effect,

whereas, 10 drop doses of saturated solution given to the same patients were not at all well tolerated. *Iodalbin*, in similar doses, is very readily assimilated and tends to act with good effect.

It is advisable to reduce enormous doses after a month and continue from eight to ten weeks with 15 to 20 grain doses, two or three times daily. Warm baths, copious water drinking and free catharsis will keep the elimination at the point necessary to prevent iodism.

If the therapeutic test in syphilis of the nervous system is positive, and the first energetic treatment has been all that could be desired, patients should be encouraged to take a course of iodide and mercury every six months for five years, and some specific treatment is indicated for a short period every year for the rest of their lives.

In not a few cases antisyphilitic therapy is an utter failure and all specifics must be discontinued. Tonics, diet and hydrotherapy are then indicated and under all circumstances a life free from excesses and cares.

#### PARASYPHILITIC DISEASES.

##### **Tabes Dorsalis and General Paresis.**

The ocular manifestations noted in *tabes dorsalis* and general paresis, consisting of the Argyll-Robertson pupil, primary optic atrophy and ocular palsies usually transient, are of such frequency and constancy as to give them great diagnostic importance. It seems germane to the discussion of these eye phenomena elsewhere in this volume to outline here the treatment of these affections of the nervous system.

##### **Tabes Dorsalis.**

*Synonyms: Locomotor ataxia; posterior sclerosis of the cord.*

A chronic disease of the nervous system almost always associated with antecedent syphilis and characterized by a degenerative process in the sensory nerves, posterior spinal roots, posterior columns of the spinal cord, and not infrequently the cerebral axis and cerebral hemispheres. To quote Starr and agree with him is to state that "Locomotor ataxia is a chronic disease of the sensory portion of the nervous system."

*Treatment.* The very slow progress and tendency to spontaneous remission in this affection makes it impractical and well-nigh impossible to suggest a therapy for certain "stages," such as the preataxic or ataxic, which are merely convenient and now obsolete descriptive terms. It should be understood that from the very first this disease is incurable, progressive, often remaining stationary for

a long time in the benign and milder forms, and yet capable of marked improvement following the exhibition of diverse *reasonable therapeutic measures*, employed singly or in such combination as to meet the requirements of each case. There should be no hesitancy, however, in acknowledging that on the whole only a minority of the cases are influenced in their course or arrested in their development.

*Prophylaxis.* Recognizing tabes not as a *direct* manifestation of syphilis, but as a *sequel* of it, there surely is good reason for referring to a prophylaxis in the sense of a timely, conscientious, energetic and long-continued treatment of syphilis at the time of its very first appearance. In fact, the ideal prophylaxis would consist in the prevention of syphilis, "a consummation devoutly to the wish'd," and one which has engrossed the attention of Metchnikoff, Roux, Neisser, and other scientists for some time. Erb, Fournier, Neisser, Leredde and many others in control of a large statistics, are of the opinion that *adequate antisyphilitic therapy* greatly diminishes the liability to tabes at a later period. The fact that tabes may develop in spite of the most intensive specific treatment should not so much determine our attitude in the matter of prophylaxis as those data placed at our disposal after a most extensive and exhaustive inquiry. Neisser's inquiry (*Deutsche Med. Woch.*, 1902) into 445 cases of tabes is interesting on this point; 254 (57 per cent.) of the 445 tabetics had received no primary antileptic treatment; 18 ( $\frac{1}{4}$  per cent.) were adequately treated; 173 (39 per cent.) inadequately. Schuster (*Deutsche Med. Woch.*, Dec., 1907), in a critical retrospect of the subject of parasymphilitis, arrives at quite different conclusions, maintaining that (1) the clinical average of tabes and paresis is identical, whether antecedent syphilis has been treated with mercury or not; (2) the metasyphilitic nerve sequelæ do not appear later in the patients treated with mercury than those untreated; (3) the beneficial influence of antispecific therapy for the prevention of parasymphilitic nerve lesions is thus far not convincingly proven. In our present state of knowledge concerning so-called parasymphilitic diseases, extreme views pro and con as to the merit of early and ideal antispecific treatment will continue to enliven the pages of our literature on the subject, but, in my opinion, *all forms of syphilis, and particularly, the milder ones, those treated either indifferently or not at all, must be held in higher therapeutic regard.*

Symphilitics much more than normal individuals must guard against such undesirable influences and excesses as tend to further embarrass their physical strength and reduce their resistance. Fatigue, excessive venery, immoderate use of alcohol and tobacco, undue ex-

posure to inclemencies of the weather, and mental stress or strain in business should be avoided.

*Causal Treatment.* Here again the propriety of specific treatment has been a matter of ardent controversy. Theoretically, treatment is certainly not indicated, since tabes is neither a tertiary nor a late manifestation of syphilis; but, again, experience seems to have counted for much, and Erb ventures the opinion, in which other investigators join him, that "antisyphilitic treatment in tabes, especially if early resorted to, and with some necessary modifications, is undoubtedly beneficial in the majority of the cases, but in only a few is this benefit decided." This statement, though qualified, is apt to work much harm. By many neurologists of large experience the value of the administration of mercury and iodides in tabes is liberally discounted, and by some absolutely discredited. I share with them the belief that antisyphilitic treatment, except in the very smallest number of cases, is not only *not indicated*, but *positively harmful*.

Those contemplating a thorough trial of this treatment will find it without advantage in (1) amaurotic types with early optic atrophy (Starr), or altogether *contraindicated* in patients (2) whose tabes is well advanced and of long standing, associated with emaciation, anemia or cachexia, and (3) in whom several previous courses of treatment have been badly borne or wholly without benefit.

The advocates of antiluetic treatment regard mercury by inunction with great favor when given in doses of  $\frac{1}{2}$  to 1 dram, rubbed into the skin daily, each time on a different non-hairy surface, until the physiological effect is produced. (For various and refined methods, *vide* syphilis of the nervous system.) The *iodides*, potassium preferred, from small to massive doses (20 to 100 drops) of the saturated solution, or *Iodonucleoid*, grs. 5 to 60, are to be given in connection with the mercurial drug. Copious water drinking, affording free diuresis, moderate catharsis and active elimination through the skin by frequent warm baths, is essential to the good result attending a protracted treatment with mercury and iodides. If the first course of mercury proves beneficial, the iodides in moderate dosage, gr. xv to xx, t. i. d., should be continuously given, and after a free interval of four months the inunctions resumed, this time giving about ten to twenty rubbings. Subsequent series of inunctions will depend upon the need for them and the tolerance shown by the patient. It is necessary to guard against stomatitis, to encourage good food in plenty, and enough outdoor life to alternate with very moderate attendance upon business. Arsenic, sodium cacodylate, glycerophos-



phates and hypophosphite are of service and among the measures that constitute a *tonic alterative treatment*, to alternate with the specific, repeated at stated intervals of four or six months, and in this way kept up for several years with advantage.

Tabes may be caused by other conditions than syphilis, contentions by some authors to the contrary notwithstanding. Is it desirable to subject the non-syphilitic cases to specific treatment? Perhaps little good and much harm has come of it as a common and routine practice. In those instances where the casual relation of syphilis can be *positively* excluded, there is ground for wholly *excluding specifics*, relying entirely on other methods of treatment. Certain drugs have found favor in the non-specific cases of tabes for their good effect upon metabolism, the circulation, and a supposed affinity for nerve tissues. (1) *Arsenious acid* (gr. 1/60 to 1/30), t. i. d., *cacodylate of sodium*, gr. 1/6 to 1, t. i. d., *atoxyl*, a white, odorless powder, soluble in 20 per cent. hot water, and containing 37.6 per cent. metallic arsenic, is especially adaptable for hypodermic purposes, and may be given in doses of three to fifteen minims of a 20 per cent. solution; (2) *Silver nitrate* continues to be used. Starr suggests that it is best assimilated in a capsule with kaolin (the pill form with vegetable extract converting it into an oxide of silver). The administration of gr. 3/4, t. i. d., taken for several months, should be interrupted if a dark bluish discoloration of the gums or mucous membrane appears. Of the colloidal silver preparations *callargolum* has been introduced in solution per rectum (8 to 15 grains) once a day, but such treatment seems to me rather far-fetched.

The treatment with *organic extracts* of brain, cord and testicle and various animal lymphs is absolutely discouraging, and, in the present state of our knowledge concerning their action, *contraindicated*.

*Symptomatic Treatment.* Of the numerous anodynes recently employed for the lancinating pains and crises in tabes, antipyrin, grs. v to xv, phenacetine, grs. v to xv, and *pyramidon*, grs. iii to v, are effective. Gowers employs and recommends *aluminium chloride*, gr. iii to v, t. i. d. Codeine (gr. 1/4 to 1) may be added to any of these when required. Morphine used with judgment is permissible when the pain is agonizing and beyond the control of other measures. The gastric crises are best treated by the withdrawal of all food by mouth and the substitution of high colonic flushings with sterile water or normal saline. Internally, ice pills and cocaine hydrochloride, gr. 1/3 to 3/4, may be serviceable. The laryngeal crises surrender best to

inhalations of chloroform, or cocaine sprayed into the throat, but here, as in all tabetic crises of degree, *morphine* will eventually be found necessary, even indispensable, and should not be withheld.

The bladder function, frequently an early source of discomfort, requires punctuality in micturition, the patient being instructed to empty the bladder every three or four hours during the daytime, and often enough at night to avert the accumulations of large quantities of urine in an atonically distended viscus. The readiness with which catheters are used is to be deprecated. Large doses of *nux vomica* may be of value.

Cystitis must be prevented, so far as it may be, but when it does develop, systematic self-catheterization, aseptically performed, may prove expedient. *Urotropin*, gr. v. to xv, t. i. d., is the best drug for this condition. Sexual impotence resists all treatment, and sexual hyperesthesia, so very distressing when present, succumbs, but very poorly, if at all, to bromides.

Tabetic arthropathies do not yield to surgical methods, and are best left alone. Decubitus and trophic disturbances require cleanliness and skilful nursing. Perforating ulcer should receive local care, frequent surgical dressing, and sometimes tends to heal by stretching the nerve trunk supplying the affected part. For the optic atrophy, *strychnine* hypodermically has been advocated, with the qualification that sight improves, which, however, is only temporary. The various kinds of counter-irritation to the spine have gradually been done away with, and perhaps the only form still retained for the relief of hyperesthesia in spots and zones on the skin, is the faradic-brush very gently applied. The delayed and impaired temperature sense in tabes should provoke great care and moderation in the employment of external heat by poultice, water bag or hot bottle.

Electricity as a therapeutic agent in tabes has gradually fallen into disuse until now only a few enthusiasts find it useful or profitable to apply mild galvanism to the spine. Suspension as a mechanical measure is no longer in use.

*Hydrotherapy* here, as elsewhere in the treatment of chronic spinal diseases, does good by relaxing the musculature, improving elimination and promoting sleep, but it is important to add that *the merit of the bath depends in no way upon any mineral constituent in the water, but upon its moderate temperature*. Experience teaches that hot or cold baths are injurious and that between 80° and 96° Fahr., is the most acceptable temperature. Whether the tub or sitz bath, spinal douche or spray is used, this latitude should be observed. Two or three months of daily bathing should be followed by an equal

free interval. The warm bath following the mercurial series should not exceed 95° for ten minutes, and the daily bath while under iodides is best tolerated at 90° for fifteen minutes. Salt glows and alcohol rubbings, so popular as a part of bath treatment, are allowed. The warm moistures from a tepid pack to the extremities often relieve the lancinating pains. It may be relevant to state that some tabetics are so hyperalgesic to water of any temperature that only a sponge bath is tolerated.

Massage is of value in the early and late stages of the disease.

That most important and distressing symptom of tabes, ATAXIA, has for years received careful consideration and study from Frenkel, of Heiden, who finally was able to evolve and formulate a plan of treatment for the inco-ordination of tabes, now known as *Frenkel's re-education method*. Frenkel postulates the "necessity of learning by systematic practice, co-ordinated and proper movements in place of ataxic ones."

A perfect system of graduated exercises, first simple and later more complicated, is performed every day, for five minutes, with a rest period of five minutes following. Patients are directed to intelligently and perseveringly practice certain movements and steps in many directions until they can do them correctly and with satisfaction and comfort to themselves. For the bedridden patient, exercises of flexion, extension, abduction and adduction should be performed in the prone position with deliberation and exactness. Such practice results in most gratifying improvement of gait and station in patients who for several years may have been helpless. It may be relevant to add that strict adherence by the patient to the highly complicated plan of Frenkel is, in my opinion, not essential, for I have seen most marked improvement follow my simpler suggestion that exercises be done in a "hop scotch" chalked out on the bedroom floor. A pattern parquet floor will suffice, and the seams in the carpet or cracks in sidewalk will answer the purpose, provided the maneuvers are planned to meet the requirements of each case, and the proper patience is observed in their execution. The inference to be drawn is that the *principle of the Frenkel treatment is an excellent one, but unvarying obedience to a single formulated plan or system of exercises is not necessary* for the attainment of good co-ordination.

For detailed reference, the reader is referred to Frenkel's monograph (*Die Behandlung der tabischen ataxie mit Hilfe der Uebung*).

When *hypotonia* is present in the musculature of the foot, tending to destroy its long arch, a pronated foot results, which by some, who have given the condition careful thought and study, is considered a contributing factor in the ataxia of the lower extremities. (Schwab

and Allison, *Jour. Amer. Med. Ass'n*, Dec. 6, 1905.) A correction of the faulty mechanism of the foot by a shoe modified to meet the individual requirements, together with the Frenkel exercises, offers a favorable treatment for the inco-ordination of tabes.

When ataxia is very acute in onset and rapid in its progress, attended with great weakness and debility, as is not infrequently the case in so-called *acute tabes*, *absolute bed rest*, and quiet, with occasional Frenkel movements, is not only desirable, but essential.

It is sometimes very difficult to decide whether or not the patient should know his true condition and be apprised of it in terms of locomotor ataxia or tabes. Much will depend upon the temperament of the patient, but in any event he may be told that he has some chronic spinal irritation, capable of control and relief by judicious and careful treatment. It is indicated in this, as in all severe chronic conditions, to practice a mental therapy by virtue of which the patient may remain hopeful, encouraged, and stimulated to activity and obedience in the matter of taking proper care of himself. He should be made to change his occupation, if that were necessary or desirable, and he should not want for the constant direction and supervision of his working and resting hours. The *psychic* side of the tabetic must never be lost sight of.

#### General Paresis.

*Synonyms: General paralysis of the insane; dementia paralytica; meningo-encephalitis; progressive general paralysis.*

Paresis is a diffuse degenerative disease primarily affecting the cerebral cortex and eventually all parts of the nervous system. It is characterized chiefly by enfeeblement of the mind and widespread paralysis of the body, both of which are progressive and usually fatal within a period of three years.

*Treatment.* Here, as in tabes, the antecedent disease invariably recorded is syphilis, but the active syphilitic process stands in no direct causal relation to the paresis. The remote predisposing rôle of lues has caused antisyphilitic remedies to be recommended by some, but such treatment has been so uniformly negative in its results, and even harmful, that it should be most restricted and as a routine practice condemned. When paresis is in its incipency (preparetic stage) and atypical, or the possibility of cerebral lues calls for great care in the diagnosis, the energetic administration of specifics may retard some symptoms in the one instance, and clear up doubt as to the nature of the lesion in the other. If specific therapy is insisted upon, it may be given after the manner prescribed for tabes. The tendency to discountenance the importance of syphilis in subsequently developing paresis is best seen in the efforts of the Scottish school (Bruce Robert-

son, etc., and O'Brien in this country) to identify a diphtheroid bacillus and advocate a mixed toxic infection as the cause, raising the question of the propriety of serum treatment. The investigations thus far presented are interesting, but in my opinion, far from convincing. The unusual susceptibility of the weakened parietic to drugs, even in small dosage, should be remembered.

*Hygienic Measures.* The patient's immediate withdrawal from business, its cares and responsibilities, and from social obligations is imperative, and if the privacy of the home and the care given there fail to exert a beneficial influence, then *institutional régime*, with its approved methods of hydrotherapy, exercise and feeding, is to be emphatically urged. In fact, sanitarium or asylum care is indicated in many cases from the very beginning of the disease to safeguard the patient against his own excesses and the family from embarrassment resulting therefrom. Skilled attendants are essential to either the home or sanitarium care especially when patients approach dementia and the terminal stage.

Much of the mental exhilaration bordering on mania and the motor restlessness may be controlled by daily *prolonged tepid baths*. *Hyoscine hydrobrom.*, gr. 1/100, and repeated, is of service here. For insomnia a warm bath at bedtime, massage and a single dose of either veronal, gr. v, trional, gr. xv, sulphonal, gr. xv, isopral, gr. iv to x, or paraldehyde, 5i, taken preferably with hot milk or hot water, will be found effective.

Catharsis is important and should the patient become refractory to the taking of medicines, it may be necessary to accomplish depletion by giving croton oil, gtt. ii, placed on the tongue with sweet oil. Epileptiform seizures and status epilepticus may be favorably influenced by bromides and chloral per rectum in adequate doses. In the terminal stage, catheterization and nasal feeding will be found necessary, and such measures of personal cleanliness as will tend to avert decubitus and other trophic disturbances.

#### **Multiple Sclerosis.**

*Synonyms:* *Multiple cerebrospinal sclerosis; insular sclerosis; disseminated sclerosis.*

Multiple sclerosis is a disease of toxic origin affecting both the spinal cord and brain in varying degree, and at any and all levels. The sclerotic foci irregularly and widely disseminated throughout the nervous system give rise to a great variety of symptoms of which the more common are muscular weakness and spasticity, intention tremor, nystagmus, scanning speech, augmented by special sense changes, anomalous reflexes, bulbar disturbances and psychic phenomena.

Of the cranial nerve changes, those relating to the optic nerve (50 per cent.) and ocular muscles (17 per cent., Uhthoff) are conspicuous.

Holden (*Jour. Am. Med. Assn.*, July 11, 1908) has recently ventured it as his opinion that a *non-toxic retrobulbar neuritis*, not due to syphilis, sinusitis, diabetes, neoplasm or trauma, is, as a rule, a manifestation of multiple sclerosis, even though all other symptoms of this disease are absent. So much greater then the necessity for ophthalmologists to know something of this disease, however unpromising its therapeutic prospect.

*Treatment.* Prophylaxis and causal treatment are futile. The rapid development of weakness and spastic paralysis early in the disease frequently calls for prolonged rest in bed. There are few diseases in which there is a more pronounced tendency to remissions and exacerbations, and in each acute aggravation a rest cure may prove necessary. Much benefit when in or out of bed is to be derived from the employment, for both upper and lower extremities, of the Frenkel exercises (*vide* Tabes), modified to suit the muscular and motor impairment in each case. In no instance would it be wise to practice one system of gymnastics continuously. Only as the symptoms warrant should a graded system of exercise, massage and movements, and bathing combined, be carried to the point of a good gain, and then interrupted until the next evidence of decline appears.

Good nutrition must be maintained and re-enforced by plenty of fresh air, various "water cures" and resorts, where the equable division of rest and diversion will materially influence all parts of the body and conserve the general strength. Daily baths are permissible, but the temperature should never exceed 90° to 95°. Electrotherapy is of no value, and may prove harmful.

In the chronic spinal diseases it has been the habit to give the iodides in small doses (sodium iodide, gr. x-xx daily) for a long period of time, but I am unable to confirm the appreciable improvement noted by others in cases so treated. Apparent benefit has come from the judicious use of arsenic, quinine, cod liver oil and other tonic drugs. In the terminal stages, when cystitis and decubitus supervene, appropriate measures are indicated.

In all the efforts at treatment, a proper value must be placed upon the tendency to spontaneous remissions. What has been said of the enormous importance of suggestion and mental therapy in chronic invalidism from tabes, applies with equal force in multiple sclerosis.

#### **Hereditary Ataxia (Friedreich's Ataxia).**

A disease first described by Friederich in 1861, largely hereditary



and familial, occasionally sporadic, characterized pathologically by a hypoplasia, degenerative atrophy (sclerosis) of the posterior columns, pyramidal tracts, cerebellar lateral column tract, Clark's columns and the cerebellum itself. Clinically, there is ataxia (cerebellar type), and latterly a spastic paraplegia, nystagmus, lost knee reflex, speech defect and a progressive tendency to general helplessness.

Pierre Marie has described cases of cerebellar disease also hereditary with onset of symptoms after puberty in which cerebellar type was a distinctive feature. While there is a general similarity of symptoms in the two forms, *the eye findings are totally dissimilar*. To enable a casual differentiation of the two clinical entities, exclusive of transitional and intermediate forms, the following table (Church and Petersen) may suffice:

<i>Friederich's Form</i> (Hereditary Ataxia.)	vs.	<i>Marie's Form.</i> (Héréd-ataxie Cerebelleuse.)
Hereditary spinal ataxia appears usually before puberty.		Hereditary cerebellar ataxia appears usually after puberty.
Choreic movements in the upper extremities and oscillations in head and trunk frequent.		Very common and pronounced.
<i>Optic atrophy and amblyopia very exceptional.</i>		<i>Common.</i>
Tendon reflexes diminished or absent.		Increased, foot clonus frequent.
Club-foot and scoliosis common.		Exceptional.

*Treatment.* The course of this disease is slow but progressive, and in the matter of treatment we are helpless, as we are in the presence of all other hereditary neuropathies. For the ataxia the Frenkel exercises (*vide* Tabes) have been employed, but without success. Electricity is of no value, Too much exertion is to be avoided, for fatigue leads to bed-rest, with its increasing enfeeblement. Supportive diet, and good nursing will accomplish more than medication.

#### **Syringomyelia.**

Syringomyelia is a disease of the spinal cord characterized anatomically by cavity formation within it of varying length, and, clinically, by an early onset and a chronic progressive course, during which symptoms such as atrophy of the muscles, quite definite sensory disturbances and vaso-motor trophic phenomena, occur. Eye symptoms are not common, but involvement of the optic nerve, pupils and ocular muscles has been sufficiently reported to deserve mention. In fact,

Schlesinger, in his classic monograph (*Die Syringomyelie*, 1895, Leipzig), notes 33 ocular palsies in 300 cases, slightly over ten per cent.

*Treatment.* There can be neither a prophylactic nor causal treatment suggested in this disease. Only *symptomatic measures* are in place here, and relate largely to the relief of trophic disturbances and the care of the skin surfaces. Owing to the characteristic sensory dissociation, peculiar anesthesia, degrees of heat, for instance, are not properly appreciated, and burns follow. Patients should be warned against heat-containing devices and advised of the importance of keeping all the skin surfaces well bathed and clean and free from local inflammation and pus infections.

Surgical measures for the deformities of dystrophic origin are contraindicated.

### **Multiple Neuritis (Polyneuritis).**

Multiple neuritis *per se* is not so much a disease entity as it is a symptom-complex capable of great variation, depending upon the cause and the particular peripheral nerve groups involved.

It is produced by a great variety of causes of which *chronic alcoholism* is by far the most common, but other *poisons*, such as arsenic, lead, phosphorus, mercury, ergot, sulphide of copper, coal tar products, illuminating gas (carbon-monoxide), furnish additional causes, grouped together as toxic forms of exogenous origin. In a second group are the cases developing subsequent to *acute infections*, diphtheria, typhoid, grippe, scarlet fever, measles, pertussis, small-pox, sepsis; to *chronic infections*, some of which are beri-beri, tuberculosis, syphilis and leprosy. Another group of cases is chiefly of *auto-toxic origin*, and arises in the course of diabetes, gout, pregnancy and the puerperium, senility, general cachexia and intestinal toxemia. Some authors refer to Landry's paralysis as idiopathic polyneuritis and consider beri-beri as a disease *sui generis* (Cassirer).

Multiple neuritis causes some signs and symptoms that are quite constant in nearly every case, no matter what the cause. The motor and sensory involvement is multiple, bilateral and symmetrical; paralysis is of the flaccid type; the tendon reflexes are lost in the affected extremities; trophic disturbances are present, as is also the electrical reaction of degeneration. These are the qualifying symptoms of a degenerative lesion of the lower set (peripheral) of motor neurons. The clinical picture of multiple neuritis, depending upon its many causes, varies too widely to admit of extended comment in an article of this kind.

The fact, however, that the cranial nerves may become involved in the course of multiple neuritis and affect the eye by occasionally

causing *ocular palsies* and very rarely an *optic neuritis*, is some warrant for considering here, in brief, the disease and its treatment.

*Prophylaxis.* Striving to reduce the extraneous sources of infection and toxic poisons to their minimum will not always suffice to prevent the occurrence of multiple neuritis, for the reason that such effort does not take into account or seek to eliminate individual susceptibility, which plays a rôle of considerable importance in this particular affection. We are in no position to satisfactorily explain why nerve tissue should attract one poison with disastrous result to itself and remain unaffected in the presence of another, or why one substance acting upon a mixed peripheral nerve elects to disturb sensation much more than motion, or vice versa, or why alcohol prefers to paralyze the legs and lead the arms, again with a selective exemption in typical cases of the supinator longus. These are and perhaps must remain inexplicable phenomena that repose deeply somewhere in our neuropathic constitutions and lie there in wait as predisposing causes to defeat some of our best efforts at effectual prevention. It is to be hoped that the use of a universal antitoxin (Ehrlich) against sepsis in many of its forms, or a specific serum-therapy against certain of the acute infectious diseases, will tend to eliminate post-infectious types of neuritis.

*Causal Treatment.* The direct causal factors referred to in a preceding paragraph are amenable to considerable control and especial attention should be paid to the convalescence from infections, various dyscrasias, diatheses, and the chronic forms of gastro-intestinal auto-intoxication.

Since it is only the chronic alcoholic who is predisposed to polyneuritis, timely advice as to the danger of continuous indulgence is much in order, and this applies quite as appropriately to the women as to the men, for many cases of neuritis are traceable to their unobtrusive excesses in this direction.

Arsenical and lead poisoning may in a large degree be averted by the proper supervision of industrials having to do with these preparations. The careful and repeated examination of patients taking arsenic, particularly Fowler's solution, will by the prompt recognition of physiologic and toxic action of this drug avert the disaster of arsenical neuritis.

Resourcefulness in methods of active elimination is important in combating all forms of toxemia. The kidneys should be flushed; the circulation neutralized by the absorption per rectum of large quantities of normal saline solution. Sweating and brisk catharsis are also valuable adjuncts for this purpose.

*Symptomatic Treatment.* When neuritic symptoms appear, the indication for *absolute rest* is established and becomes imperative. The dangers of over-treating must now be avoided. It is quite enough to secure *immobilization* and *warmth* at this stage of the disease. All undue efforts, such as attend eating, the voiding of urine and passage of solid feces should be restricted as much as possible. *Pain* will be greatly relieved by rest and relaxation, but analgesics and coal tar derivatives will in most cases have to be administered. The number of old reliable and newer preparations is large enough to facilitate a choice, and antipyrin, *phenacetine*, acetanilid, salicylates, *salophen*, salipyrine, *pyramidon*, singly or in combination, may be used to advantage. Any undue depressant action likely to follow the exhibition of any coal tar preparations is best avoided by combining with each dose camphor monobromate and caffeine citrate, each gr. i. If the pain is too intense to succumb to these remedies, codeine sulphate, gr.  $\frac{1}{2}$  to 1, and even morphine sulphate, gr.  $\frac{1}{4}$  to  $\frac{1}{2}$ , will be found necessary.

An ample, rich, nutritious diet is indicated, and if, as in diphtheritic forms, swallowing is difficult (pharyngeal palsy), the feedings should be given by means of a stomach tube. Edinger (Pentzoldt and Stintzing) emphasizes the value of milk, butter, buttermilk, bacon and a diet otherwise rich in fats. Moderate and uniform heat is of benefit in controlling pain, stimulating surface temperature and capillary circulation. Owing to the danger of producing ulceration on skin surfaces already prone to trophic disturbance, I prefer wrapping the extremities in thick rolls of cotton wadding or flannel to either the hot or cold applications. In the acute stage Oppenheim recommends that a *diaphoretic treatment*, consisting of hot drinks, hot packs, superheated air, etc., be given the patient for from one to two hours daily. Counter-irritants are now little used. Local anesthetics and rubifacients are to be discouraged.

*Electricity* is generally applied with but little understanding and discretion in neuritic disturbances. It should only be used after the subsidence of pain or when the acute symptoms have run their course. Too often the neuritis is greatly aggravated by the premature and ill-advised use of the electrical current. So as not to add irritation to pre-existing irritability of the nerves, a *measured, weak, interrupted galvanic current should be applied for a short time each day* to the impaired muscles, with a view to gradually increasing the strength when nutritional and functional improvement warrant it. Massage, too, should be reserved for the late reactionary stage and

active movements and gymnastics *withheld until returning strength indicates their daily use.*

In the acute stages care should be exercised to avoid every semblance of pressure through weight of the bed-clothes, and such malpositions of the extremities as wrist or foot-drop (extensor paralysis) should receive enough support from splints, sandbags and sundry devices to overcome as much as possible the contractures likely to develop. For the late, neglected deformities of high degree, *orthopedic* measures will be found necessary.

A tonic, supportive treatment after the acute stage is passed is of importance and the administration of elixir of iron, quinine and strychnine is indicated after meals. Strychnine hypodermically, gr. 1/60 to gr. 1/20, three times daily; arsenic in small doses; oleum morrhue; hypophosphites, etc., will prove of undoubted value in building up the tissues. With judicious treatment and close attention to details and to the needs of the patient as they arise, the results of treatment in multiple neuritis are most gratifying.

## CHAPTER XVIII.

### TREATMENT OF THE MORE IMPORTANT DISEASES OF THE NERVOUS SYSTEM THAT AFFECT THE EYE.—CONCLUDED.

*Exophthalmic Goiter—Acromegaly—Facial Tic—Chorea—Epilepsy—Migraine—Hysteria—Neurasthenia.*

#### **Exophthalmic Goiter.**

*Synonyms: Morbus Basedowi; Graves' disease; Parry's disease.*

Exophthalmic goiter is a disease presenting, as a rule, a triad of cardinal symptoms, exophthalmos, tachycardia and an enlarged thyroid, with which may be associated a fine tremor, vaso-motor and visual disturbances, nervous and mental phenomena and characteristic ocular manifestations. Which of the classic or accessory symptoms are most often in evidence in all cases it is difficult to say, but tachycardia is probably the earliest and most constant finding.

The disease is essentially chronic and of obscure origin, but in all likelihood depends upon an over-activity or perversion of thyroid gland function. (Theory of hyperthyroidism—Möbius; Johnson). An explanation of the real cause and genesis of disturbed thyroid function is not at hand.

The protruded eyeballs, various characteristic lid signs, and extrinsic ocular palsies, corneal changes, anomalies of lachrymation and other minor abnormalities constitute findings of importance and particular significance to the ophthalmologist.

The many theories advanced at one time and another concerning this disease have greatly enriched its therapeutic aspects, but it is only fair to add that many, indeed very many, of the remedies suggested are not even of problematic value, and not a few deserve frank condemnation.

*Hygienic and Physical Measures.* When this disease is in its incipency, presenting only slight acceleration of the pulse, perhaps some sleeplessness, nervousness, gastric distress, sweating, and a sense of easy fatigue, and the cardinal symptoms have not as yet made their appearance, it is of the first importance to relieve the patient of the anxieties and cares of his or her occupation, and urge comparative rest. If a loss in weight has been sustained, a diet of milk and nutritious food, largely vegetarian, should be encouraged, but flatulency



must be avoided or controlled so far as possible. Tea and coffee should be allowed in great moderation, and alcohol or tobacco forbidden. The patient should be asked to lead a regular life, free from excesses, and avoid such strenuous activities as riding horseback, rowing, dancing, etc. Should tachycardia and nervousness persist and increase in spite of these directions, a *complete rest*, as ensured by the Weir Mitchell rest-cure, is indicated. The good influence of climate has been commented upon in treating Graves' disease, sojourns in mountainous regions of low altitude and at warm seashore resorts being advised. Hydrotherapeutic measures are of advantage in the control of nervousness, especially the prolonged tepid bath, followed by an invigorating "salt glow." Cold, in the form of the ice-bag, applied over the precordium is of service in allaying undue cardiac palpitation and reducing the tachycardia.

*Electricity.* The actual value of electro-therapy in this condition has never been determined and even its relative utility may be said to have decided limitations. The galvanic current has been recommended, with instructions to place one pole (anode) over the sternum and the other (cathode) at the angle of the jaw, allowing a mild uninterrupted current to pass for about five minutes at each treatment. I have seen a slight reduction in the goitrous enlargement follow this sort of stimulation, but it was too insignificant and temporary to prejudice me in favor of its use. In line with these attempts to reduce the goiter have been the efforts directed at mechanical compression by a large collodion patch or bandage placed over the gland, both of which measures are valueless.

*Organotherapy.* The theory of hyperthyroidism a number of years ago created a vogue for organotherapy in this disease, which was neither well founded in principle nor proved in fact. Thyroid preparations were recommended and held in high favor. In consonance with the thyreogenic theory that *hypersecretion* occurs, the administration of *thyroid extract* would appear to be illogical and contra-indicated, and on the assumption of a *perversion* of glandular secretion would rest only a relative indication for its use. Iodothyryn after a fair trial has been found wanting. Thyroid extract, gr. v, has in an overwhelming number of cases so aggravated the symptoms as to warrant its disuse. Other glandular preparations advocated for use, such as thymus extract, ovarin, "probylin" (Roche), have proven uniformly disappointing. If MacCallum's deductions are to be accredited that the parathyroid glands in all likelihood have nothing to do with the development of exophthalmic goiter, then parathyroid extract can occupy no rational place in the therapy of this disease.

Within the past few years a serum from thyroidectomized animals (sheep) has been introduced for trial which to all intents and purposes is to act as an antitoxin in Graves' disease. The "*anti-thyroidin Mæbius*," marketed by a well-known German pharmaceutical firm, has been extensively used, with some good palliative effect. I have had occasion to use it in several cases in ascending doses, and arriving at fifteen drops, three times a day, after meals, have observed a favorable influence upon the tachycardia and subjective accessory symptoms, which improvement became more marked as the dosage reached twenty-five drops. In one case I recall rapid decrease in the goiter, but no other response to the treatment, even when pushed to forty drops, three times daily. In each instance the serum was administered by mouth in increasing dosage, and reduced gradually to the starting-point of eight drops. This preparation is marketed in small glass vials containing 10 c. c., its stability ensured by an admixture with 0.5 per cent. carbolic acid solution.

The Mæbius serum will be found too expensive (\$1.50 per vial) for average use, and its curative effect certainly must be denied, but it is likely to afford more marked temporary relief in a large series of cases than other preparations similar in kind. Not a few organotherapeutic specialties have been made marketable, such as rhodagen, Basedowsan, and Lantz has encouraged the use of milk of thyroidectomized goats, but these are therapeutic refinements of very doubtful value. In this country *thyroidectin* (grs. v) given from three to twelve times daily received a thorough trial, during which some brilliant results, even cures, were reported, but on the whole the preparation does not stand approved.

*Symptomatic Treatment.* The selective treatment of one or more of the aggravating symptoms in this disease is seldom contemplated until hygienic measures and a thorough trial of complete rest have been instituted and found ineffectual. If nervousness is conspicuous, it is to be met with sedatives, such as bromides, and even chloral in aggravated cases. When a tumultuous and rapid heart action continues to distress the patient, bromides, together with rest and the ice-bag, may suffice quite as well and even do better than the heart tonics, digitalis, strophanthus or sparteine sulphate, which usually fail to control tachycardia and precordial distress. Gowers advocates the use of belladonna (until the mouth is dry and the pupils are widely dilated) to allay cardio-vascular throbbing.

The *phosphate of soda*, grs. x to xv, in warm water after meals and at bedtime, is of benefit in many cases, but when it causes

diarrhea, the phosphate of potash is, according to Bramwell, to be preferred.

Babinski attributed good results to sodium salicylate, grs. xv, given three or four times daily.

Forchheimer has had an extensive experience covering more than twenty years with the *hydrobromate of quinine*. He gives gelatine-coated pills four times daily for a long period (in one instance for nearly three years), containing quinine hydrobromate. grs. v, and adds ergotin, gr. i, if the quinine preparation alone proves ineffectual after taking it for forty-eight hours. Forchheimer's strong prejudice in favor of this remedy is based in part upon the treatment of twelve florid cases with only three failures, and upon the abortive types in which uniformly good results have been obtained. He acknowledges failures in the foudroyant form and in isolated instances where the drug seemed inert for no apparent reason. He has found very noticeable improvement in the type "developing during or after the menopause." Under this treatment tachycardia subsides, the goiter is diminished in size, the tremor disappears and exophthalmos recedes. Noting improvement after the first forty-eight hours, Forchheimer advises continuance of the dosage until "all the symptoms have disappeared," which "in fully developed cases has required from four months to three years." In his opinion, the test of complete recovery is based upon the withdrawal of the quinine, absence of symptoms for a period of two weeks entitling the patient to the distinction of being cured. No attempt is made to explain, other than hypothetically, the action of quinine in these cases, nevertheless the treatment by so careful an observer as Forchheimer, of forty-one cases of Graves' disease with only five failures makes worth while the extended mention of this medicinal remedy.

*Surgical Treatment.* Among the early operative measures devised to cure this disease were those of stretching the cervical sympathetic (Jaboulay, 1895) and resection of the entire cervical sympathetic chain (Jonnesco, 1896), both of which procedures seem based upon mistaken theoretic premises. Sympathectomy has been attended with such indifferent results as to have found little favor. Poncet's exothyreopexy (exposure of a lobe of the gland and its extrusion through the skin incision in the hope that it would atrophy) was fraught with grave danger and is now obsolete. Ligation of the four arteries of the thyroid gland, first recommended in this disease in 1886 by Woffler, is still performed, chiefly by Kocher, who, however, makes it a preliminary step to *partial thyroidectomy*. Landström's experience has led him to advocate excision of one lobe together with

ligation of the superior thyroid artery of the other side. (*Ueber Morbus Basedowi.*) The incomplete resection of the gland first described and performed by the Kochers, at the present time takes precedence over all other operations, and has given a fresh impetus to the surgical possibilities in this disease. Within the past five years some large and very convincing *surgical* statistics have found their way into the literature of Graves' disease (Kochers, Mayos, Heineck), such as bid fair to establish a habit for operating all cases of exophthalmic goiter, irrespective of disease indications which must be strict, or surgical ability which should be adequate.

From the large series of cases thus far compiled, it would appear that partial resection of the thyroid gland holds out the promise of (1) very definite improvement in the incipient cases, and (2) amelioration of accessory symptoms in the well developed and even advanced cases, where medical measures have failed. The Mayos (*Ill. Med. Jour.*, Oct., 1907) conclude that "practically all cases are improved over their former condition, and most of them are cured." With the advent of renewed surgical interest in Graves' disease, the indications for the operation seem to have undergone some change and the surgeon requests, or better said, prefers that the mild *incipient cases* come to thyroidectomy, and in these cases gives the considerable assurance of a cure. Hardly enough time has elapsed however in this development period of goiter surgery to say just what constitutes a cure, and what types of the disease have the best prospect of it. The internist has set the indication for surgical intervention when (1) an increasingly large gland produces compression or suffocative symptoms, or (2) the decline of the patient is rapid, in spite of all available medical treatment; that is, in the presence of increasing emaciation, uncontrollable tachycardia, or continued fever. If a patient is already profoundly toxic or has organic heart disease, operation should not be advised, but it should be the concern of the physician in constant attendance upon a case to prevent as far as possible such progress in the disease as will take it out of the realm of operability.

Although the surgical aspect of exophthalmic goiter is most alluring, reflected from a large and rapidly growing and favorable statistic, it is nevertheless *premature to regard it as a surgical disease*. Eulenberg, with his six hundred carefully recorded cases, is one of those who have no hesitancy in stating that Basedow's disease is not even to be regarded as debatable borderland, but for the present must remain "upon the certain ground of internal medicine, and only under most absolute necessity should we swerve to the surgical

side." When we have arrived at a better clinical valuation of the abortive, larval, aberrant and pseudo-types, and come to know more about thyroid toxemia and subtoxic thyroid states, then our present tendencies may undergo enough revision to allow of a conservative attitude.

The exophthalmos and corneal ulceration occasionally require surgical care. Posey suggests a light pressure bandage in the early stages to reduce a slightly protruding eyeball, and median, lateral or combined tarsorrhaphy when the prominence is great or corneal ulceration impending. He also recommends flushing the conjunctival cul-de-sacs several times daily with a solution of boric acid (grs. x to  $\bar{5}$ i) to prevent corneal ulceration, and two or three drop instillations of atropine (grs. iv to  $\bar{5}$ i), night and morning, if erosion is present. Careful cleansing with 50 per cent. strength of hydrogen peroxide and the application of hot compresses for one-half hour at a time, three times daily, will complete the toilet of the ulcerating area. Subsequent opacities will require special ophthalmic surgical intervention.

#### **Acromegaly (Pachyacria).**

In neurologic literature acromegaly has tentatively been classified with other disorders supposedly of trophoneurotic origin and without known anatomic basis. It is an affection regarding the probable nature of which many theories have been advanced. Marie, in his "theorie hypophysaire," expressed the belief that all the phenomena of the disease, constituting as they do a systematized dystrophy, are caused by *primary* changes in the pituitary body. von Recklinghausen and others have maintained that the disease is *first* a trophoneurosis with secondary changes in the pituitary body and thyroid, causing a perversion or absence of secretion in these glands. Benda's view of over-activity of the cells in the anterior lobe of the hypophysis has led to a conclusion that the gland may be the "growth center." These few opinions are cited merely to emphasize the fact that in acromegaly the hypophysis has nearly always been found diseased and hypertrophied, but all else concerning pathogenesis and etiology remains obscure.

An enlarged pituitary gland is capable of exerting pressure symptoms in all respects analogous to those of brain tumor in the same location, compressing the chiasm, optic nerves and other adjoining areas. From this it must follow that bitemporal hemianopsia, ocular palsies and optic atrophy (40 per cent.) occur as important physical findings in a symptom-complex further characterized by headache,

vomiting, vertigo, glycosuria, sexual disturbance and enlargement of the face, hands, trunk and feet.

*Treatment.* So long as we are in doubt or ignorance as to the pathogenesis of acromegaly, we must be content to rely upon such remedial measures as will *palliate* but in no sense cure. The disease to date has acquired no promising surgical aspect. Some isolated instances are recorded in which osteoplastic resection was done for relief of pressure headache or peripheral neurectomy for neuralgia (Keen-Hinsdale). Extirpation has been undertaken in cases of tumor of the hypophysis (Caton, Paul, Horsley), but no deductions should follow from a few single instances with negative results. For the closely related condition of cuttiasis ossea Kanavel in an excellent and comprehensive discussion of treatment, advocates a palliative operation for relief of "cerebral compression and encroachment upon the orbital and nasal cavities." (*Surg. Gynec. and Obst.*, June, 1907.) It would seem rational therefore to advise a *decompressive operation* as palliative for choked disc and chiasmic symptoms due to enlargement of the pituitary (*vide* Brain Tumor).

*Animal extracts* have been suggested for this condition, but the slight transitory relief afforded in only a few cases warrants mere mention of their questionable utility. Thyroid extract, when pushed to its physiological and even toxic effect, has been of benefit in minimizing such subjective symptoms as headache, nervousness and insomnia (Putnam). It may be given in dry powdered gland form, beginning with gr. i, three times a day, after meals, and increased until grs. xv are given daily or every second day.

The *pituitary extract* is best given in tablet form, gr. iii t. i. d., but in one case under my personal observation the cephalalgia was so intensified by its use that after several trials it had to be discontinued (Hecht: *Jour. Am. Med. Assn.*, 1905) Its therapeutic value, of which we know almost nothing, will remain indifferent, until more knowledge of the physiological value of the hypophysis will be forthcoming.

Mercury and iodide are said to have a good effect in some cases admittedly not of syphilitic origin.

For the relief of headache, which may be agonizing and intractable, acetanilid or phenacetine and similar coal tars in larger dosage than ordinarily given, gr. vi to xv. are indicated and do much good.

When the disease begins to seriously impair the general health, weight and strength, tonics, good food and conservation of energy are necessary.



**Facial Tic.**

Facial tic requires to be carefully differentiated from facial spasm before a prognosis may be ventured or treatment advised. The participation of the eye and eyelids in the two affections so alike in their external manifestations yet so diametrically opposed in respect to etiology and pathology, frequently causes confusion in ophthalmologic diagnosis and error in treatment.

*Treatment.* Tic is a mental affection amenable to cure "if one can will to cure it." Spasm results from a material irritative lesion in any part of the facial nerve from its cerebral or nuclear origin to its terminal branches. The idea of the incurability of tic has prevailed for so long that the majority of cases, except for some feeble effort, remain untreated. This neglect is not justified, since some improvement may be afforded even the most refractory types, and in the milder forms, cures effected.

Although they have, on the whole, proven inert in reducing or controlling the convulsive movements, sedatives and hypnotics, such as bromides in large doses, chloral or the various preparations of opium, may afford some transient improvement. In this connection it may be observed that the tendency of "ticquers" to develop mental disturbance renders the use of heavy hypnotics in general and opium in particular inadvisable. A variety of other drugs, zinc valerianate, gelsemium, quinine, arsenic and cannabis indica, have from time to time been tried, with negative results.

Electricity, massage, facial douching in one form or another are to be discouraged except when they are known to exercise a good psychic effect, but mechanical devices to arrest the tic are valueless.

*Hypnosis* is credited with some good results, and *suggestion* during waking hours is favorably regarded, but as some authorities reflect, "To encourage the patient and assure him of progress, to reproach or reprimand him on occasion, is to employ an integral and invaluable factor in all re-educational treatment of tics; but is this truly suggestion?" "*Treatment by re-education*" has through the effort of Brissand, Meige and Feindel and others of the modern French school of neurology become a recognized method, requiring infinite patience and ingenuity on the part of the doctor and patient. One can only enunciate the principles, not the rules, that apply in this broad method. They are: (1) The value of motor discipline, the discipline of immobilization. (2) Mirror exercises, enabling close observation and direction of motor control. For instance, in *tic of the eyelids* the repeated rhythmical opening and closing of the eyes, the steadying of the lid in a half open or half closed eye.

all of which exercises are to be done with the head in different positions, are of distinct value. In *eyeball tic* other maneuvers have been described (Meige), such as dissociating the movements of eyes and head; keeping the head stationary while the eye is made to slowly follow an object or conversely letting the head rotate in horizontal and vertical planes while the eyes are fixed.

These are but fragmentary suggestions of a method which to be highly effective must be individualistic in application.

Absolute rest in bed for all cases has been authorized by some observers as the best treatment, whereas others have found it doing far more harm than good. I can personally subscribe to the view that even much bed rest as a general measure is undesirable. Nine sleeping hours by night for a psychoneurotic individual and perhaps one or two hours of midday napping is very beneficial as a relaxant. If unusual nervous irritability obtains with marked obsessional phenomena in a run-down and anemic ticquer, then a rest-cure treatment seems indicated.

The wisdom of enforcing *isolation* in these cases should depend more upon the nervous and mental complex of the patient than upon the severity of the tic. Relative retirement, with appropriate diversion and an agreeable occupation, does more good in the average case. *Rational psychotherapy* in addition to *motor discipline* of the order mentioned rounds out the medical treatment of tic.

For a purely obsessive disease there can be no *raison d'être* in surgical treatment except in so far as it may subserve a psychotherapeutic purpose, in which event it seems more heroic than wise.

### Chorea.

In describing the treatment of chorea, one becomes aware of bringing forth little of anything new, certainly nothing revolutionary. Any one of a series of measures has been accepted, which, without being strictly indicated, may be given at some time in the course of the disease. Based upon the literature and a personal observation of a moderately large series of cases, the inference would be justified that *cases of minor chorea of moderate severity show no great differences in their duration, whether under a treatment entirely expectant or strenuously medicinal.*

Taking them all in all, the mild together with the severe cases, one cannot help but feel that the appropriate treatment for chorea comprehends: (1) Rest and isolation; (2) improved hygiene and nutrition; (3) drugs judiciously used. Disregard for these measures frequently results in a failure to get an ideal cure in chorea,

and there often remains the impress of permanent instability upon the general nervous system.

*Rest (Isolation) and Diet.* Here, as elsewhere in medicine, *rest*, ever so respected in the theory, is not sufficiently urged in the practice. The element of *complete rest* cannot be overestimated in chorea, and especially is this true of its service in the earliest period of the attack. It is quite the logical, the natural thing to advocate it when the twitchings are so severe that there ceases to be an alternative. It is the patients of robust build, florid complexion, with very slight twitchings, who are advised that they may remain up or lie down, or do a little of either. In these individuals, the needful amount of rest is not prescribed. The advice the lighter cases of chorea should receive is, in effect, that theirs is a disorder in which anemia, general malnutrition and endocardial mischief may conspire to inflict irreparable damage, that these sequelæ must not only be anticipated by the physician, but promptly averted, so far as that is possible with *rest*.

It is always indicated to immediately take choreic children out of school, away from the confinement of the class-room, remote from the atmosphere of intense study and rigid discipline. Above all things, the parent should realize the futility of whipping the choreic child for apparent awkwardness and a display of temper, and be enjoined from inflicting every kind of punishment or restraint. But that is not all. Once removed from school and tenderly treated, the child should not be left to indulge in play as a beneficial form of relaxation.

It is far way from the leisure and relaxation of normal play to rest as it should come to be understood and valued in the treatment of chorea. Here, rest implies emancipation from all kinds of physical and mental excitement. The run-down, pale, irritable, overwrought, twitching child must be put to bed in a quiet place, be treated by a quiet, unobtrusive individual, in a quiet manner. Left to its own devices, a child restless and not very sick will soon crave entertainment, but such diversion should not be of its own making. It is misplaced kindness to load a little patient down in bed, with games and playthings without number, and have all the neighbors' children in, crowding the sickroom, to help pass away the weary hours. It is imperious to keep the choreic child passive; therefore, it must be read to, talked to, sung to; in short, entertained.

Should rest prove very irksome, as it not infrequently does, thereby aggravating all symptoms, reasonable measures of repose on a couch or reclining chair should be tried, always, however, with

an intent to supply the element of amusement. The management of such changes in a long siege of bed rest requires much tact and ingenuity.

Timely rest in the severer forms of chorea may entirely ward off and will surely minimize the danger of the much-dreaded endocardial complications, and its effectiveness in these cases is the greater as we encourage with rest, *isolation*. In grave instances, the mental irritability, the excitable and exhausted physical state, demand this seclusion.

It is not at all uncommon for the muscular twitchings and bodily unrest to be so great that ways and means of avoiding self-inflicted injuries must be devised by the generous use of mattresses, cushions, pillows and side-bars, padded with cotton. I have seen a child, eight years old, whose seizures threw her violently from the bed to the floor, and for whom this sort of restraint became necessary.

Need I add that every plan contemplating rest should include the consideration of a light, sunny, and well-ventilated room? Warm sunshine should never be at a premium in the sickroom of a choreic child.

Adjunctive to rest, isolation and hygiene, and quite as essential as any of these, is the matter of *food* and *feeding*. The diet should be light, non-stimulating, nutritious, easily assimilable, and given in abundance. The latter advice is emphasized not for the reason that these children are deliberately underfed, but accidentally so, owing to the embarrassment they are made to feel by the severe twitchings and incoördination. The giving of liquids is frequently curtailed for the same reason and the insufficiency of fluids, together with an excess of highly nutritious foods, tends to constipation. Tea and coffee are interdicted. All writers are agreed that fats are positively indicated, and, therefore, advise milk, cream and butter in great plenty, but good soups, meat, fish, eggs, spinach, lettuce; in short, the nitrogenous foods, are not to be omitted.

When a patient is given to taking too much farinaceous food, it is very liable to produce excessive flatulency, thereby increasing the sense of palpitation, which may already be severe, from cardiac involvement *per se*, or the degree of anemia invariably present in advanced cases. I have had occasion to give Kazol a fair trial in cases where milk was either not well borne or disliked, and have found it very satisfactory.

Under *general measures*, we should have in mind the importance of *baths*, in conjunction with gentle *massage* and very moderate *gymnastics*. That the warm bath acts as a sedative and eliminant to

an irritable nervous system is conceded, and Hollopeter goes so far as to say that the bath in his hands has been the entire and most satisfactory treatment. He advises a bath at a temperature of 90° to 98°, such as will neither surprise nor shock the child, who is to be immersed in the water all except the head and neck and allowed to remain there for at least an hour or two at a time, twice a day, the last ten minutes being devoted to properly given, gentle, light massage. The prolonged warm bath in one series of fifty cases is said to have shortened the attacks from three months to six weeks.

In the severe cases, attended with great muscular weakness, gymnastics will prove harmful, but in the milder forms moderate exercises are permissible, and may have a beneficial effect.

Throughout the active periods of the disease, in some cases, emotionality and perverseness require moral restraint, and so it frequently happens that isolation or hospital treatment is of better avail than the sympathetic interference of meddling relatives at the home. The convalescent choreic must not be allowed to prematurely return to school and studies. Here a long vacation has its distinct advantages.

The medicinal agents called into use in chorea are, broadly speaking, the tonics and sedatives. Of the former, arsenic in one form or another has by common consent been accorded the first place. It has come to be considered the remedy *par excellence*, and as such is another brilliant instance of empiricism in medicine.

von Bechterew has sought to put the value of arsenic and its action in chorea on a scientific basis. He does not speak of it as a nutrient to nerve tissue, as older writers do, but thinks that it acts on the nerve centers, then on the nerves, the reflexes, and finally on the spasmodically twitching muscles. His premises are doubtful. Now and then we hear enthusiasts or the uninformed referring to Fowler's solution as a specific for chorea, a statement which savors strongly of extravagance and not at all of the truth. The liquor potassi arsenitis is, from an orthodox viewpoint, no doubt, the sovereign remedy in this affection, *but in no sense may it be called a specific*. Arsenic acts with very good effect on many patients, but its universal administration has shown that a large percentage of choreics remain unbenefited, and I think it neither merits nor enjoys the reputation or popularity accorded it in the past. The *toxic effect* of arsenic should always be borne in mind, especially in office practice, where it is customary to thoughtlessly prescribe four ounces of Fowler's solution, and fail to caution the patient as to the puffiness of

the eyelids, gastric disturbances, paresthesias and weakness in the extremities, which latter two symptoms appear as the forerunners of an *arsenical neuritis*. This form of toxic paralysis is not to be confounded with the appearance of a disseminated neuritis, which Mills says occurs in certain stages of chorea, just as an arthritis or endocarditis occurs and independent of arsenical treatment.

Spiller has made reference to a number of cases of arsenical neuritis reported, and has himself observed one. Comby has met with such an experience, and Patrick has seen it where large doses of arsenic were given. The original advocates of massive doses of arsenic, Ziemssen and Seguin, and, later, Comby, have found few supporters. To me it seems immaterial whether the neuritis occurs in idiosyncratic individuals or from prolonged large dosage; the point to be remembered is that arsenical neuritis may and does occur, and with the knowledge of such consequence it is incumbent upon everyone administering arsenic to inquire into sensory symptoms and carefully test from time to time the knee-jerks, which, if diminished, should suggest the immediate withdrawal of the arsenic. The ambulatory type of case frequenting the office or the dispensary is not the one from which to draw satisfactory inferences as to treatment. In office practice, whenever administering arsenic, the following precautions should always be observed:

(a) Deny the renewal of the prescription by writing *non repetatur*. (b) Never let the prescription call for more than four drams of the liquor potassi arsenitis. (c) Give the patient accurate written instructions for graduating the dose, beginning with five drops, and emphasize diluting it with large quantities of water, to a pint, if necessary, to be taken in divided doses. (d) Caution the patient to observe puffiness of the eyelids, nausea, paresthesias and weakness in the extremities. (e) Test the knee-jerks (yourself) at each visit.

It might be well to add that arsenic is generally well borne by the young, and for a child of six or more years to tolerate as much as twenty-five drops of Fowler's solution in a large dilution of water after meals without adverse symptoms is not at all unusual. Thus far preëminence has been given Fowler's solution, but other forms are deserving of mention. Of these I would refer to arsenious acid, which, given in pill form, may contain from 1-100 to 1-30 of a grain. Where great gastric intolerance is present and the chorea steadily progresses, it is indicated, according to Eulenberg and Wiederhofer, to use arsenic subcutaneously. A standardized five per cent. aqueous solution of *sodium arsenate* may be injected deeply



under the skin in ten to twenty minim doses, which latter amount is equal to fifty-two minims of Fowler's solution. The injections, given every second day, have an appreciable good effect in those cases which have hitherto been refractory to Fowler's solution. Even Fowler's solution may be put under the skin in five-drop doses, but some writers discourage all hypodermatic use of arsenic in children.

That chorea has in the past received a fair share of attention from those having remedies to exploit is seen from the very long list of drugs, good, bad and indifferent, cited in the literature, and it is no less amusing to note with what sincerity writers in the past have subscribed to certain of these drugs. As a result of the efforts made to reach special conditions in chorea, such as the insomnia, vesical irritability, etc., the list of remedies is almost interminable, but for purposes of completeness several may be mentioned and a few selected for comment. Belladonna, the hyoscin group, ergot, cannabis indica, exalgin, cimicifuga, strychnia, the iron preparations, the bromides, chloral hydrate, antipyrin, the salicylates—all have been used, though latterly Babinski suggests scopolamine hydrobromate. It is claimed that where chorea has for its basis no other cause than a general lowering of vitality, associated with malnutrition and anemia, strychnia and the iron tonics are of the greatest value. In connection with the rheumatismal types, the *salicylic acid group* is effective. Among the sedatives, chloral and antipyrin are indicated.

Strychnia as an alterative was first employed by Trousseau and given in the form of the sulphate, with the object of substituting tetanic contractions for the clonic movements. It is agreed by all who use it that the strychnia is best given with large doses of syrup, preferably the syrup iodide of iron, and those who think well of this combination say it must be pushed to a point where there is a feeling of tension in the back leg muscles. The iron preparations are too many to enumerate. Suffice to say that iron in an assimilable and palatable form is indicated and well borne.

The esteem in which *antipyrin* is held by those who have used it freely in chorea is the more astonishing when we reflect upon the misgiving and fear that attends its administration as an antipyretic in the various acute febrile attacks of the adult. Wallner, in 1887, was the first to advocate its use and reported most favorably upon its effect. It is supposed to have a hemolytic action by virtue of which the twitchings are ultimately made to subside. It is then neither as an antipyretic nor analgesic that antipyrin finds its application in chorea, but as a sedative. The tolerance which the young exhibit for antipyrin, given in massive doses and for weeks at a stretch, is well known to those familiar with this remedy. I have myself in a severe

case given five grains every two hours in the twenty-four, then reducing the dose to an average of forty grains daily, maintaining that therapy for a week without any show of cyanosis or cardiac depression and with marked improvement to the chorea.

Exalgin, analogous in action to antipyrin and very well thought of by Lowenthal and Dana, has never been extensively used. It is claimed that in a dosage of from  $\frac{1}{2}$  to 3 grains (for a child under ten), three or four times daily, the drug acts powerfully enough to abbreviate the attack, and is of greatest service in the cases of acute onset. Those who have used exalgin tell of its very marked hemolytic action, producing early anemia with grave symptoms of collapse, and for this reason it seems to me to be open not only to criticism, but serious objection.

*Salicylic Acid Group.* In chorea of the rheumatismal type we are confronted with valuable therapeutic suggestions from many reliable sources, all of which point to the employment of the salicylic acid group of remedies.

Lees has vouched for the efficiency of sodium salicylate, and claims that the failure of anti-rheumatic treatment may be owing to the insufficient dosage. He combines heroic doses of salicylate (100-120 grains daily) with large doses of bicarbonate of soda, and attributes his successes to this combination. These views are not unanimously approved.

*Aspirin* (aceto-salicylic acid) has its ardent supporters. It is advised to be given without an alkali, as the drug is likely to decompose in the stomach.

Children take aspirin well; it may be given in doses of fifteen grains, three to six times a day, for a child ten to twelve years old, and in ten grain powder for a child of six to eight. Wall thinks it is best given stirred up in cold milk and taken on a full stomach. Occasionally it is rejected, but on the whole it is much better borne than the salicylate of soda, and is not nearly so often attended with the disagreeable symptoms of salicylism, such as deafness, tinnitus, etc. Chloral hydrate, advised twenty-five years ago by Gairdner in England and Bouchut in France, has been employed very little, although its good effect as a sedative is conceded. Opium and the bromides, also much used in the past, have been discarded.

Babinski ascribed his success in the treatment of a case to the use of scopolamine hydrobromate, 2-10 to 5-10 mg. *pro die*, given under the skin. He remarked upon the quick subsidence of the choreic movements, and added that he had now tried it in four cases with uniform success, and in one of these antipyrin, arsenic and chloral had failed.

Summarizing the therapeutics of chorea, it seems to need revision in favor of the *simplest measures*.

### Epilepsy.

The symptoms arising in the course of an epileptic attack have to do with abnormal changes in consciousness and motility. This being true, the clinical manifestations are of necessity either mental or physical, or both. Their wide range and great variability make it difficult and on the whole unsatisfactory to formulate a brief or accurate definition of the disease, but the one suggested by Spratling seems very acceptable: "Epilepsy is a disease or disorder affecting the brain, characterized by recurrent paroxysms, which are abrupt in appearance, variable in duration, but generally short, and in which there is impairment or loss of consciousness, together with impairment or loss of motor co-ordination with or without convulsions."

The *ocular symptoms* of epilepsy are manifest (1) as a part or whole of an aura, when they are purely visual and entirely subjective; (2) during the first stage of the fit, when we note variable forced deviations of the eyes and transitory pupillary changes; (3) in a post-convulsive period there may appear conjunctival hemorrhages; (4) strabismus, nystagmus and diplopia are reported as occasional sequelæ.

*Prophylaxis.* Conceding the undoubted influence of heredity in the transmission of epilepsy, the physician is not infrequently called upon to advise as to the feasibility of *marriage* where one of the contracting parties is epileptic or is known to have had epileptic antecedents. The particular emotions that find their best solution in matrimony are usually too intense to be dominated by much medical guidance, but it is none the less incumbent upon a conscientious physician to discourage such marriages. The marital relation of epileptics cannot of itself be said to modify the type or course of the disease, but in the matter of procreation the danger lies, and who that has seen the blight of epilepsy upon a child would sanction a union in which distinct heredity is acknowledged to and evident? It is not easy, however, to give advice to that class of cases in which epileptic or epileptoid phenomena have occurred somewhat later than in the infantile period, in the absence of referable cause or hereditary taint. Here, after a careful survey of the facts and a frank statement by the physician of the possibilities (however remote), the final disposition must rest entirely with those chiefly interested. Neither the wisdom nor justice of such legislation as has been enacted for the control of epilepsies need receive comment here.

The prompt recognition of the mental, moral and physical needs of the neuropathic child and the institution of such medico-

pedagogic measures as will toughen its physical and psychic fiber is a firm step made in the direction of effective prophylaxis. A predisposed child should not be made to enter school or embrace any competitive opportunities until quite equal to the exertions requisite thereto. A combination of school and sanatorium in a quiet, rural environment, where selective study and an equable division of work and play (especially out-door) is planned, should prove most beneficial for neuro or psychopathic types. Especially desirable is it to tide such a child well over the trying period of pubescence. After that, good hygiene and a wise general supervision in the adolescent years will accomplish much.

The convulsive seizure of infants, so readily ascribed to teething, intestinal worms or "mere fever," is all too lightly regarded and inadequately treated at the time of first occurrence. I incline to the belief that it requires but very little irritation to a supersensitive or super-excitable group of cerebral cortical cells, to promptly establish a tendency to convulsions which in later years become frankly epileptic. The timely exhibition (at the occurrence of the first seizure in infancy) of very small doses of *sodium bromide*, *gr. i to ii, with or without chloral, gr. i*, in emulsion, given per rectum, and repeated for some days at a time, may do much to avert subsequent cerebral explosions. Better therapeutic observance of night terrors, bed wetting, fits of uncontrolled temper, and perverse headaches will also reduce the incidence favoring later epilepsy.

The mental and physical development of an epileptic should not be undertaken contingent upon epilepsy *per se*, as is so often the case, but upon the *individual* who has epilepsy in one or another form and degree. Instruction and exercise must not be denied him on general principle, but be nicely proportioned and so adjusted as to meet *his capacity* as an individual epileptic. Too often is the epileptic asked to conform to *general advice* and told indifferently to live a life of so and so. Not sufficient regard is shown for those personal attributes of mind and body, which, when painstakingly directed, enable the sufferer to pursue a day's work with greater happiness to self and better service to the community at large. Educate epileptics according to their mental qualifications and physical powers, providing them with graded instruction that is manual, rather than purely intellectual, in well equipped special institutions, or arrange for their private tuition. In the early stages of this disease mentality is hardly ever disturbed, much less impaired, hence asylum treatment is to be discountenanced. If confinement be at all desirable, special hospital wards, set aside for epileptic cases only, should be provided. This method of treating in seclusion the early and ad-

vanced cases alike has proven very satisfactory and led to a now quite universally approved and adopted plan of out-door *colonization* for the epileptic. A systematic out-door life, giving preference to light, open air occupation, together with enough study and reading to avert mental sluggishness, is what epileptics most need and should have.

The *food* prescribed for epileptics should fulfill the conditions of being non-irritating, easily digestible and nutritious, but in all other respects adapted to the particular needs of the individual patient. There are those who have seen fit to advocate a rigid vegetarian diet, deprecating meat of all kinds, while others again suggest meat in great moderation and altogether interdict red meat. I have not been able to note the favorable influence of specialization in diet.

The success with which food is assimilated depends quite as much upon the quantity as the quality of the meal, hence *moderation in eating* is of great importance. Patients must avoid alcohol in any form and take coffee or tea but very sparingly. Tobacco in moderation does no harm. *Constipation* is to be avoided. When the occurrence of epileptic phenomena can be brought into direct causal relation with some underlying pathology, such as brain syphilis, tumor or cerebral arteriosclerosis, these conditions then require appropriate treatment before one may hope to control the seizures. Unfortunately, the sources of epilepsy commonly referred to as peripheral are not discovered, and the treatment from beginning to end remains purely symptomatic.

The neurologic version of *the relation of eye strain to epilepsy* is quite at variance with the one firmly held to by some ophthalmologists. Gould has written extensively in support of his belief that epilepsy is not infrequently cured by the relief of eye strain, accomplished with properly fitting glasses. Ranney and Stevens, also impressed with the factor of eye strain, believe that muscle imbalance corrected by operation, cures epilepsy. The report of a most careful and scientific investigation made by Gould and Bennett, on 78 epileptics at the Craig Colony, in 1902, to ascertain the *facts* is interesting, but it is recorded that no relief followed. The premises for the experiments were most favorable. The diagnoses were made by Drs. Gould and Bennett, the glasses carefully fitted by an expert optician, and the cases subsequently observed daily by a physician, who could reassure himself that the glasses were constantly worn. A record of all epileptic attacks occurring day and night in these cases was kept for one year, and it is conclusively proven from this series that the 31 males who had 766 seizures during three months prior to wearing glasses had 765 in the first three months after, and 1,332 during the first six months after; that in similar intervals 33 females had 670 before, and 592 and 1,426 attacks respectively after. The *negative* character of the results em-

bodied in this tabulated report (Spratling: *Epilepsy and its Treatment*, would tend to discredit any theory that eye strain could initiate or by its presence aggravate epileptic seizures.

*Medical Treatment.* Since their introduction some fifty years ago the *bromides* in one combination or another have been a sovereign remedy for the control of the epileptic fit. In the majority of cases, either potassium, sodium, strontium, ammonium bromide singly or together, are capable of diminishing the seizures in frequency and intensity, but there is very little likelihood of their complete arrest. To achieve results with bromides, they must be taken in adequate doses for a continuous period of time, and then at the risk of developing symptoms of bromism, viz., widespread acne and marked cerebral depression. It is well to be conservative in prescribing the initial dose of bromide, being careful to test it out and give no more than is needed to control the attacks. The best time for administration will depend largely upon the periodicity of attacks. Bromides are best taken an hour after meals, with large dilutions of water. Observation in each case will alone determine the dosage, which in adults may vary from fifteen grains to sixty grains, three times daily, but it is highly improbable that these doses can be maintained without evidence of bromism.

The prevention of *bromism* is desirable, and to this end active elimination through kidneys, bowels and skin is encouraged. Liquor potassi arsenitis (Fowler's solution), two to five drops, added to each dose of bromide, will lessen the liability to the widespread acneiform skin eruption. During an attack, the patient, if he has fallen in an uncomfortable or dangerous position, should be moved to safety, and all neck clothing opened or removed to allow of free breathing. A cork, clothespin or knotted corner of a handkerchief may be shoved between the upper and lower teeth to prevent repeated tongue biting incidental to the clonic stage. Especially in the *nocturnal types* of epilepsy, when the force of a convulsion turns the patient face downward in the pillows, must suffocation be averted by the prompt intervention of someone near at hand. For status epilepticus inhalations of chloroform to the anesthetic degree are indicated.

The *opium* treatment for "fits" is as old as Paracelsus, but had been abandoned these many years, until Flechsigs, in 1893, reintroduced it in combination with bromides, to be given in chronic cases, where bromide alone had failed. The plan is to mildly narcotize the patient for a month or so, beginning with small doses of opium, and increasing same gradually until fifteen grains are taken daily. The sudden withdrawal of opium at this point, substituting 120 grains of bromide daily for two months, and gradually reducing that dose to



twenty or thirty grains, constitutes Flechsig's method of administration. The majority of observers who have given this measure extended trial do not regard it with much favor. *Borax* (sodium borate) has been extensively employed by some, because of Gower's recommendation. In doses of from 10 to 30 grains, t. i. d., it may reduce the number of seizures in a few cases.

Occasionally, in the senile or arterio-sclerotic cases, nitroglycerine, gr. 1-100, taken several times daily, is of service in lessening the attacks. It is hardly necessary to more than mention amylene hydrate, chloral, chloretone, tincture of belladonna, urethan, simulo and solanum carolinense among the many preparations that have been enlisted in the service of controlling epilepsy, and are of very doubtful value. It is premature to say much of the prospect of serotherapy in this disease, but thus far the results have been disappointing.

*Surgical Treatment.* There is no field for surgery in cases of *essential* epilepsy, nor have the prophecies concerning surgical achievement in the cases with a local exciting cause been fulfilled. In some traumatic cases where a sharply circumscribed lesion from depressed fracture or hemorrhage can be *early* diagnosed, *prompt* surgical interference may bring about the cessation of convulsions. When epilepsy is associated with irritation referable to the nasopharynx, eyes or ears, local improvement may ameliorate the symptoms, but tampering with normal ovaries, or performing hysterectomies, and maltreating the pelvic viscera and genitalia in general in a vain endeavor to cure epilepsy, are practices of which too much cannot be said in condemnation. The *Jacksonian* or symptomatic types of epilepsy, in which the etiology, focal symptoms and seizures point to some gross, *circumscribed, accessible* brain lesion, are regarded as suitable for surgical intervention, but it cannot be said that the results of operation are any too favorable. When a meningeal hemorrhage has occurred in a child, resulting in the cerebral type of palsy, the *immediate* exposure and removal of a circumscribed clot may perhaps prevent a subsequent palsy and seizure, but if scar tissue once has formed, it seems quite improbable that it can be excised without replacing it with an artificial (operative) scar, but little less inclined to cause convulsions than the original one.

#### **Migraine.**

*Synonyms:* *Hemicrania; sick headache; megrim.*

Migraine, a distinctive type of headache or head pain, the origin of which remains very obscure, occurs most frequently in persons of a neuropathic constitution and is acquired by direct inheritance. Migrainous attacks, although variable, are, as a rule, sudden in onset,

paroxysmal, self-limited, irregularly recurrent and in the majority of cases further characterized by unilateral headache, nausea, vomiting and visual phenomena. The ocular symptoms assume such special prominence in this neurosis that to one group revealing purely sensory visual anomalies the term *ophthalmic migraine* has been applied, and for the other, presenting oculomotor paralyses (a purely motor type), the appellation *ophthalmoplegic migraine* has been suggested. In the one form (ophthalmic) a sensory nerve, the optic, is mainly involved, and in the other, the oculomotor, and more rarely the trochlear and abducens is affected, but it is not at all uncommon for these varieties to merge. Still another clinical distinction prevails, called *psychical migraine*, in which mental symptoms predominate.

The visual signs in ophthalmic migraine include, according to Lloyd, "1. Amblyopia. 2. Scintillations. 3. Scotoma. 4. Hallucinations." The ocular signs in the ophthalmoplegic type are in the great majority of cases confined to the third nerve, the paralysis of which is usually complete, but variable in duration from a few days to several or more months.

*Treatment.* The treatment of migraine contemplates the use of remedies during the attacks and between them, but it is relevant to add that all measures are symptomatic, and their number is legion. *The Attack.* The intensity of the headache in the severer types of migraine is such as to put the sufferer for the time being completely out of commission, and in the average case it is quite unbearable. The patient quickly realizes that to mitigate the pain or shorten its duration, he must seek the quiet, even the solitude of the darkened bedroom, where absolute rest and relaxation will give the remedies with which he is familiar, time to act and the headache a chance to wear off. Although much relief is hoped for from various *external applications*, patients find that neither cold, heat, counter-irritation, nor analgesic salve, when applied to the head or temples, does very much good. Of course, the ice-bag may slightly relieve one, and hot compresses another, and I have known patients whose sharp pain was greatly eased by rubbing the forehead continuously with a glass of water containing a large lump of ice. But while such measures are soothing and effective in ordinary headache, whatsoever the cause, they usually accomplish little in migraine.

It is a good plan, as soon as the prodromes of the headache appear, for the patient to take a glassful of saline laxative, either magnesium sulphate, magnesium citrate, sodium phosphate or some of the better known aperient waters. It is indicated to relieve the intestines within an hour or so, and if an enema or colonic flushing can be taken as an adjuvant, without much discomfort, it, too, will quickly

empty the lower bowel and help modify the severity of the average attack. Some physicians advise a promptly acting emetic (ipecac) and lavage of the stomach, in the hope that the hemicrania may subside more readily, and the patient, whose experience has taught him that nearly every paroxysm is terminated by free vomiting, does not regard earlier artificial emesis as any more unpleasant if it will assist in aborting the pain.

Rachford is of the opinion that attacks occurring in children yield best to calomel and soda, followed in two hours by citrated caffeine (gr. i) and potassium bromide (grs. v), every hour for three doses, and adds that this practice is likely to provoke vomiting, which, however, he regards as favorable to the termination of the attack.

With no specific at hand for this malady and palliation of pain the only alternative, it is only natural that a great number of drugs should have sprung into use, of which only a very few, however, may be recommended. Caution in the choice of an anodyne is very necessary, because migraine patients are prone to try out every kind of remedy, irrespective of its merits. The advertised headache powder in common with other quack nostrums that have a commercial value is so attractively placed within easy reach of the sufferer that a habit for an unknown drug in unsafe dosage is formed before the bad effect and even danger of such usage is fully appreciated.

*Acetanilid*, for instance, is by some observers thought to be at once the most effective and most dangerous of the coal tar products. On account of its depressant action on the heart and tendency to produce cyanosis, it is by some held to be less desirable than either phenacetine or antipyrine, but it is also a fact that because of its known efficiency and regardless of its safety, it enters into the composition of most of the popular headache nostrums of the day. None of the coal tar preparations should be given in the large doses recommended by some authors, and least of all acetanilid. *Phenacetine* and *antipyrine*, in five or ten grain doses, once repeated, in an hour, should be relied upon to dull the sharp pain of migraine, and acetanilid should be prescribed in doses not to exceed grs. vii, and is made more safe by the addition of *citrate of caffeine*, gr. i to iii, and repeated for one dose in one or two hours, if necessary. Even with this safeguard, some authors are unwilling to trust the uncertain toxic effect of acetanilid, and deprecate its use. Most of these drugs are advantageously combined with the bicarbonate of soda, salol, the salicylate group, and caffeine, and are useful as anodynes, antineuralgics and antipyretics.

In the treatment of migraine, *caffeine* in one form or another is very effective, especially if given at the onset of an attack. Sinkler suggests that pure caffeine, gr. i, at the very beginning of the head-

ache, and repeated every fifteen minutes for four or five doses, is very beneficial. The citrate of caffeine may be administered in doses of three to five grains, but in my own cases I have observed the equally good effect of a cup of strong hot black coffee. Moebius' point anent caffeine is well taken, for he says he prefers "drinking a cup of good strong coffee in the 'Kaffeehaus' to an errand at the apothecary shop."

Guarana, containing as it does caffeine and theobromine, may be given in form of a fluid extract (15 to 30 drops), the elixir (5i to 5ii), or as a powder, in 10 grain doses. Sinkler reports excellent results from powdered guarana, grs. x, with 5 grs. of sodium salicylate, given every quarter hour for four doses. The various bromide salts are of little or no service during the attacks.

For the past few years I have prescribed *pyramidon* in five grain doses, to be repeated only once (in two hours), and found it very useful. When the pain is of such agonizing character that all remedies seem futile, a hypodermic of morphine, gr.  $\frac{1}{8}$  to  $\frac{1}{4}$ , is certainly justifiable. That the habit is easily established in neuropaths who realize that at last a remedy *par excellence* is at their disposal for all future paroxysms is to be well borne in mind by the physician. It is needless to add that where attacks have been severe, light, digestible food and rest in plenty is indicated before the patient renews his activities.

*Treatment Between the Attacks.* Migraine is pre-eminently a chronic affection and if the recurrent attacks are to be at all favorably influenced it must be by way of the care and treatment bestowed during the free interval. The care of self is quite as essential as the treatment outlined by the physician, and consists almost wholly in cultivating the gentle art of *moderation*—moderation in all things—eating, working, playing, resting and worrying. If the subject of migraine finds that the frequency and intensity of his attacks unfits him for prescribed duties, it is indicated to advise or select for him an occupation conducive to a betterment of his condition. In my own experience, I can recall two instances where change of occupation was attended with most gratifying results; in one case, a bookkeeper was made a city buyer with profit to himself and his firm, and in another instance a factory chemist became an insurance agent, with enough physical benefit to himself to have never regretted so radical a change.

No definite dietetic interdictions are called for, since every individual learns in due course of time what is likely to provoke an attack. It is well, in the main, to observe the effect of a varied diet, and avoid those foods that disagree or are of themselves unwholesome. If coffee and tea are taken in moderation, they do no harm. Alcoholic beverages are undesirable, and should be strictly forbidden. Moderate smoking is allowed. When gastric hyperacidity is known to be

present, alkaline waters should be encouraged, and of these I prefer the imported French Celestine Vichy. An occasional weekly or bi-weekly purge will be of service in keeping the gastro-intestinal tract in good condition, and the general physical condition will be best re-enforced by regular hours of work, exercise, rest and sleep.

Much prominence has been given by various authors steeped in specialism to the rôle of *peripheral irritations* in migraine. There is no denying that the presence of intestinal toxemia, pelvic disease in women, sinusitis, nasopharyngeal anomalies and ocular defects with eye strain may seriously impair the general health of an individual who at the same time is a sufferer from headache, nor is it untenable to assume that the correction of such conditions will improve that general health and relieve the ache. But the contention that the removal of adenoids, cauterization of hypertrophied turbinates, or the *correction of refractive errors will or can cure genuine migraine is opposed to our present conception of the malady, and in contradiction of the post-operative facts.* It has never been my privilege to see the subject of a migraine cured or even relieved by the wearing of glasses. The common practice among many oculists of assuring patients that spectacles will cure migraine is, in my opinion, to be discouraged. In fact, our present knowledge of referred and reflex pains is too meagre to admit of more than vague speculation of one kind or another.

Ever since its first recommendation in 1872, many authors, among them Seguin and Sinkler, have written strongly in favor of cannabis indica as a most potential remedy in migraine, but not a few venture their disapproval. I, for my part, can cordially subscribe to its excellence in a majority of the cases that have come under my observation. In summarizing the method of administration, it may be said that the fluid extract of cannabis indica is the better preparation to use, the one made by Parke, Davis and Company being preferred and always specified by me. It is most essential to success in treatment to obtain a standardized preparation, especially since few drugs are more variable in strength than this. Little is to be expected from the fluid extract unless it is given in increasingly large doses, up to the physiologic and even toxic effect. It is not at all unusual for a patient to receive twenty-five or forty drops of the fluid extract, three times a day, and in several instances eighty drops, *t. i. d.*, has been reached. In cases of moderate severity, beginning with eight or ten drops, placed with a dropper in an empty gelatine capsule, the graduation of each dose is carried to the point of tolerance and kept there for a continuous period, always, however, with the patient *under observation.* It is a good plan to specify the dosage scheme on a card, which the patient carries with him. The patient can be up and about, without exhibiting

distress even from large doses. In the sévérer types it is well to institute a partial or complete *rest cure*, increasing the cannabis indica rapidly to large dosages, maintaining these for some time, and then withdrawing in favor of adequate doses of sodium bromide. Such cycles of treatment in the severer cases may ward off attacks for a period varying from months to a year or even years. When the fluid extract is not well borne, I have given the solid extract, gr. i to iii, in pill form, three times a day. It is a more convenient way of taking the remedy, but not amenable to such careful gradation in dosage. In the past year or more I have had occasion to use in a number of cases the Parke, Davis preparation, *cannabis americana* (an American grown cannabis sativa), both in fluid and solid extract form. The solid extract given in doses of gr. i has proven as therapeutically satisfactory as the indica preparation, and in some instances I thought the drug in larger doses, caused less nausea and drowsiness. Some individuals cannot take even small doses of either cannabis indica or americana without experiencing a sense of precordial distress, palpitation, surface chilling, and a feeling of drowsiness and collapse.

If after a trial of this and other remedies in an idiosyncratic individual it becomes necessary to abandon drugs, a prolonged rest in bed, with appropriate measures of massage, diet, hydrotherapy may prove very beneficial. In all cases of migraine the statements made by the physician as to prognosis and cure should be most guarded and conservative. The agony of the pain is such that bare relief is grateful when the hope of cure is long deferred.

### **Hysteria.**

Hysteria, although very generally classified in our modern textbooks with the neurologic clinical entities, is, properly speaking, a mental disorder, a psycho-pathological condition. No one who has seen much hysteria will fail to appreciate how striking and interesting among the clinical features of this protean malady may be the disturbances of vision.

*Treatment.* As hysteria reflects a morbid state of mind, which may give rise to a very great number and variety of physical symptoms, all of them, however, functional in character, it will readily be seen that the plan of treatment must be mainly psychic. Success will depend upon the mental acumen and personality of the physician, together with such novel measures as he may initiate with promptness, decision and power.

The early recognition of the symptoms as hysterical is a most valuable prerequisite to the successful treatment in any case. Wavering, dilly dallying, trying first one remedy and then another in a vain en-



deavor to relieve a distressing symptom is a tacit admission in this class of cases of the physician's inadequacy or unfitness, and it is not calculated to inspire patients with the degree of confidence necessary to the accomplishment of a cure. With no intent to deprecate the talent and skill of the general practitioner, let it be said that he is not the best nor, as a rule, the last adviser in hysterical cases. Hysteria is not a grateful disease for the general practitioner to treat. A strange physician, a specialist for the eye, if that sense organ is involved, or a neurologist familiar with hysterical ocular manifestations is in a better position to institute appropriate and effective treatment.

The physician undertaking to cure a case of hysteria must feel assured of the fullest co-operation and obedience on the part of the patient. The meddlesome interference of anxious relatives and interested friends dare not be tolerated. If it is impossible to restrain these pernicious influences, a new environment far removed from familiar scenes and faces is indicated and indeed almost indispensable to the welfare of the patient. In new and strange surroundings patients yield more gracefully to authoritative control and are more amenable to the reassurances of a cure.

Isolation, reducing as it does to a minimum extraneous psychical annoyances and facilitating in the highest degree bodily rest, is to be commended in extreme cases. When malnutrition is a feature, a modified or complete rest cure (*vide* Neurasthenia) is beneficial.

The premises favorable, every effort should be made to destroy the *obsession* or *fixed idea* that is so deeply implanted in the mind and capable of distorting, even paralyzing, bodily functions.

Hypnotism as a general therapeutic agent in cases of hysteria has met with growing disfavor, I believe, and is by many regarded as a dangerous procedure.

Of especial significance to the oculist is the treatment of hysterical amblyopia, asthenopia, and the rarer condition of amaurosis, the anomalies of eyelid and eye muscle movement, hysterical ptosis and blepharospasm. Any of these conditions may have their origin in a trivial local irritation, a fright, insignificant injury, grief, menstrual disorder, or excessive emotionalism. To dislodge the deep initial sensory impression, awaken confidence and arouse the patient to an attitude of expectation and hope will go a very long way toward the restoration of normal vision, and it matters little whether the cure is effected by leeches, magnets, the static breeze, faradization, or any of the forms of waking suggestion. A single act or word not infrequently dispels a most distressing symptom-complex. There is little need to more than mention

hydrotherapy, medicinal agents, massage, etc. All these may be valuable adjuvants with which to impress and encourage the patient.

### Neurasthenia.

Whether Beard's definition of nervous exhaustion for what was once ironically called the American disease stands approved today, or the condition is regarded as one in which an excess of irritability and debility are the prominent features matters less than the fact that neurasthenia is acknowledged as a clinical entity the world over. That the visual apparatus shares in the so-called general irritable weakness characteristic of the disease, witness the references to asthenopia, ocular muscle insufficiencies, anomalies of the visual field and neurasthenic pupillary phenomena. Defects in our present special economic and industrial system are so directly responsible for the development of the neurasthenic state that the mention of *prophylaxis* must include a rather unavailing tirade against existing conditions. It must suffice to hint that neurotic individuals should not unduly expose themselves to either the physical or mental strain incidental to the struggle for existence.

The *general treatment* includes for the average case a rational allowance of physical exercise, rest, sleep, diet, baths, massage, and interesting, mild mental preoccupation.

In the more aggravated cases a partial rest cure at home or a full Weir Mitchell rest plan combined with isolation is indicated. For the details of this well-known and now universally adopted method of treating advanced neurasthenics, the reader is referred to any of the recent works on therapy, or the small but complete book entitled "*Fat and Blood*," by Weir Mitchell, of which the eighth edition appeared in 1902 (Lippincott).

Not only should the physical condition of the patient at rest in bed be conserved, but the mental state also impressed by the judicious and constant application of psychotherapy.

Drugs of the tonic order, such as iron, strychnine and arsenic; sedatives, like bromides; hypnotics, such as sulfonal, trional, veronal and isopral, are to be given with great care and in very conservative doses when indicated. Rest and nourishment, as a rule, will accomplish more without than with medicines. Visits to spas, the seashore or the mountains are beneficial.

It is of the utmost importance in all cases to determine the causal factors in the production of the neurasthenic state, if these are present.

## CHAPTER XIX.

### THE NON-SURGICAL TREATMENT OF THOSE DISEASES OF THE NOSE AND NEIGHBORING CAVITIES THAT AFFECT THE OCULAR APPARATUS.

BY FRANK BRAWLEY, M. D., CHICAGO.

*Treatment of Infective Processes in the Nose—Formulae—Suction Treatment—Author's Suction Apparatus—Irrigation of Nasal Accessory Sinuses—Formulae and Treatment of Accessory Sinuses Following Irrigation—Vaccine Therapy, Method of its Administration—Preparation of Auto-Vaccines—Hyperesthetic Rhinitis and Alcohol Injection of Nasal Nerves—Pollantin.*

In view of the increasing prominence given to diseases of the nose and its accessory cavities in relation to ocular disease, it seems appropriate to outline some of the methods of treatment.

The chief method of dealing with pathological nasal conditions is surgical. The removal of spurs and hypertrophies, operations for draining the various neighboring cavities when infected, and the various methods of straightening deflected septa come under this heading.

*Acute or chronic infective processes* in the nose which extend to the eye, causing damage varying from a conjunctivitis to panophthalmitis, are dealt with primarily by cleansing treatment of the nose. For this purpose warm physiological saline solution is preferable owing to its non-irritating and great solvent properties. An antiseptic oil may then be used by means of an atomizer. In acute cases the following formula is applicable:

R

Camphor

Menthol

Ol. eucalypti (Binz)

Petroleni

aa gr. v. (0.35)

fl. ʒss (2.00)

fl. ʒj (30.00)

Chronic cases, requiring stimulation of a relaxed nasal mucous membrane, are benefited by the following prescription, to be used as a spray:

R

Iodi

gr. ij (0.15)

Phenol.

Camphor.

Menthol.

Ol. cassiæ

Vanillin. q. s.

Petroleni. ad.

āā gr. v (0.35)

gtt. v. (0.35)

fl. ʒi (30.00)

The iodine dissolves with great difficulty in oil so that this formula must be made by distillation in a properly equipped laboratory. The various ingredients mix perfectly in the gaseous state. Vanillin is used to cover the disagreeable iodine odor. The feed tube of the atomizer used for this spray formula should always be of rubber as a chemical reaction occurs between a metal tube and the iodine.

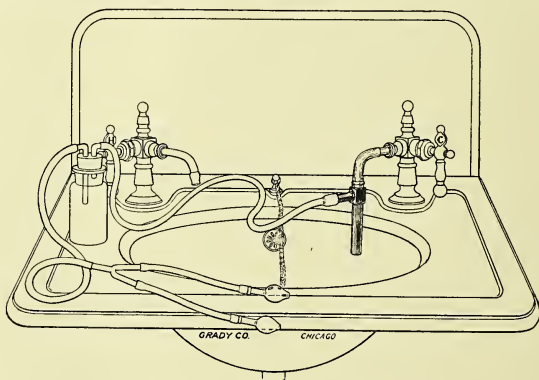


Fig. 26.

Brawley's Suction Apparatus.

A new mode of freeing the nasal accessory sinuses of morbid secretions is the suction method of Sonderrmann. It consists in producing a vacuum in the nose which causes the secretions in the sinus involved to run into the nasal meati. I have arranged a simple, inexpensive contrivance for producing the vacuum. It consists of the well-known suction pump used in chemical laboratories and is operated by water from an ordinary tap. To the latter is attached a piece of rubber tubing running to the short tube of a glass wash-bottle. To the long glass tube (see illustration) is attached another piece of tubing leading to a Y whose ends are glass or hard-rubber nasal tips. The purpose of this contrivance is to catch the secretion drawn from

the nose and prevent it from clogging the pump. With a nasal tip in each nostril the water is turned on and the patient is shown how to raise his soft palate, so as to shut off the nasopharynx from the pharynx proper, by saying "hick." From the closed cavity thus formed *the pump withdraws the mucus, pus or mucopus from the adjacent sinuses.* The excretions thus withdrawn may be inspected, as well as examined bacteriologically as a guide to further treatment as well as for purposes of diagnosis and prognosis.

As a means of *treatment* the pump may be used from fifteen minutes to one hour, the aim being to evacuate the infected cells thoroughly at each setting, using a very mild degree of suction.

The chief field of treatment, however, is to be found in the *nasal accessory sinuses.* Their extremely close relations to the optic nerve, ocular muscles, lachrymal sac and orbital nerves and blood-vessels render their pathological processes of the greatest importance.

The numerous operative procedures designed to provide drainage of these cells, by removal of obstructing turbinate bodies, of a part or of all their nasal walls, need not be described here. Conservative treatment of such conditions consists in the proper cleansing of the nose as outlined above so that infectious material may not be dammed up within the cavities by crusts formed by the drying of the escaped material in the inspired air.

Another valuable method of treatment in these cases is the removal of the infectious material by means of warm normal saline irrigations through silver canulae passed into the natural ostia, or through artificial openings, into the cells. When the irrigating fluid returns clear the sinus is dried by compressed air and then with the canula still in position various medicaments, such as trikresol 1:200, argyrol 10 per cent., zinc chloride or silver nitrate 10 to 30 gr. per oz., chinosol 1-1000, xeroform, iodoform or formidine powder, etc., are introduced into the cavity. This procedure should be carried out daily until no secretions come away with the irrigating solution.

In addition to the mechanical drainage thus obtained, the diseased mucous membranes of the cavities are rendered hyperemic by this treatment after the principles laid down by Bier.

*Vaccine therapy* has been found of great service in infection of the accessory sinuses of the nose both before and after operation. According to our present knowledge its usefulness is greatest in the subacute infections, especially after proper surgical drainage has been unsuccessful. It is of least value in the chronic forms where pathological changes have already taken place in the lining membranes of the sinuses or in their bony walls. The most approved method of con-

trolling the administration of vaccines, which by the way should be autogenous whenever possible, is by means of the opsonic index (q. v.). This is a tedious and expensive procedure, however, and very satisfactory results are being obtained by giving the proper dose of the vaccine while the patient's index is high clinically, that is, when he has a sense of well-being as against periods of depression. I give the vaccines in weekly doses but advise the patient to present himself for treatment when he is feeling well whether it be in six days or eight days, but never to come while depressed. The vaccine is administered under careful asepsis with a glass syringe, 1 c. c. being the usual quantity, the dosage, however, varying with the number of bacteria per c. c. according to the particular organism found.

The reaction from the administrations of these vaccines is usually very slight and localized at the point of injection. I have, nevertheless, had two cases of very severe general reaction with from one to three degrees of fever and requiring confinement to bed for several days. The arm where the injection was made was in these cases uniformly red, edematous, and swollen from elbow to shoulder, and the axillary glands were enlarged. A re-testing of the vaccine showed it to be sterile in each case. The reaction occurred with the initial dose which is never more than one-half the amount usually employed.

A short description of the *method of preparing autogenous vaccine* is given below and for this I am indebted to Dr. Thos. L. Dagg, of the Chicago Laboratory.

*The Preparation of Auto Vaccine.* 1. A culture is made from the discharge into bouillon or the different forms of agar and grown at body temperature for 24 or 48 hours. The growth is then studied microscopically for classification of the organism so grown.

2. Twenty-four hour agar slants of this growth are then washed with normal salt solution and an emulsion of the organism is thus obtained.

3. This emulsion or suspension of bacteria is now standardized to correspond with the proper dosage, which varies with different bacteria. In other words a method is used whereby we can calculate a definite number of bacteria in 1 c. c. of emulsion. For instance, if we are working with a staphylococcus, the usual dosage of which is 500,000,000 of bacteria, we take a measured quantity of the emulsion which we obtained by washing off the agar slants, and we add it to an equal quantity of freshly drawn blood. We mix the two thoroughly and then make a smear on a glass slide the same as in making an ordinary blood smear, for a differential count. This is stained, and we find the bacteria and the red blood cells more or less evenly dis-



tributed over the slide. Then we count various fields of the slide and compare the number of bacteria with the number of red cells found in the same area and in the same way obtain the ratio of bacteria to red cells. Then, knowing the number of red cells in a c. m. m. of normal blood, taking it as 500,000,000, we can easily figure how many bacteria we have in a like quantity of our emulsion and then in 1 c. c.

In this way we determine how much additional normal salt solution we must add to bring our emulsion down to the required dilution of 500,000,000 per c. c.

4. After having it standardized it is then made sterile by heating in a water bath for usually a half hour at 60° C.

5. Then test cultures are made from the heated emulsions and placed in an incubator for 24 to 48 hours, and if result is negative as to growth a  $\frac{1}{2}$  per cent. lysol or phenol is added as an additional precaution and it is then ready to put up in sterile containers.

*Hyperesthetic rhinitis*, under which heading Stein groups *hay fever*, "*rose cold*," etc., is usually *accompanied by marked ocular symptoms* probably of reflex character. For this condition Stein advocates the use of alcohol injections into the anterior and posterior nasal nerves and has devised a pair of special, hollow needles for this purpose. As yet this treatment is in its infancy but such good results have been obtained by similar injections in cases of severe, obstinate neuralgias that we may reasonably hope for much from its use in this most unsatisfactory class of cases.

For a number of years we have faithfully tried *pollantin* (q. v.), the antitoxin prepared by Dunbar, of Hamburg, Germany, but the results have been far from satisfactory, except in a few cases. Its practical failure as a therapeutic measure may perhaps best be shown by the fact that the Original Research Department of Parke, Davis & Co. recently sent out a statement to the effect that after most careful study and clinical experiments extending over a number of years the method had been found impracticable and their product would be withdrawn from the market.

# CHAPTER XX.

## GENERAL ANESTHETICS IN OPHTHALMIC OPERATIONS.

BY HERMAN D. PETERSON, M. D., CHICAGO.

*Principal Factors in General Anesthesia—The Immediate Safety of the Patient—Sequelæ of Anesthesia—Preparation of the Patient—Requirements of Ophthalmic Surgery—Nitrous Oxide Gas—Ether—Chloroform—A. C. E.—Ethyl Chloride—Kelene—Narcotile—Anestile—Somnoform—Administration of the Anesthetic—Dangers Near and Remote—Sequelæ and Their Treatment—Summary.*

In the production of general anesthesia for any purpose, two important factors are to be taken into account, (a) the immediate safety of the patient, and (b) the sequelæ due to the use of the anesthetic.

The first factor is always of the greatest importance.

In ophthalmic surgery, however, the second factor, in many cases, is of almost equal consequence for the reason that frequently the successful outcome of an operation is, in no small degree, dependent upon the absence of such sequelæ as straining, nausea, coughing and vomiting. These evil after-effects not rarely produce failure, in what otherwise, would have been a successful operation.

The ideal anesthetic, one whose administration is not accompanied by danger, or is not followed by untoward after-effects, is not as yet at our command, therefore in any case, we must weigh all factors and choose that agent which offers the greatest degree of safety and the least liability to the production of disagreeable symptoms.

As the technique of surgery in the field of ophthalmic surgery does not consume a great amount of time, the average operation requiring about twenty minutes, we have one advantage in that the operation being of comparatively short duration a relatively small amount of the anesthetic enters the system, consequently shorter time is required for its elimination and then less liability of its administration being followed by vomiting, restlessness, etc.

Should a skilled anesthetist be not available, the safety of the patient should outweigh all other factors and the safest anesthetic be chosen.

*Preparation of the Patient.* When, after an examination of the patient and consultation with the operator, the form of the anesthetic is decided upon, the patient should be prepared for the proposed

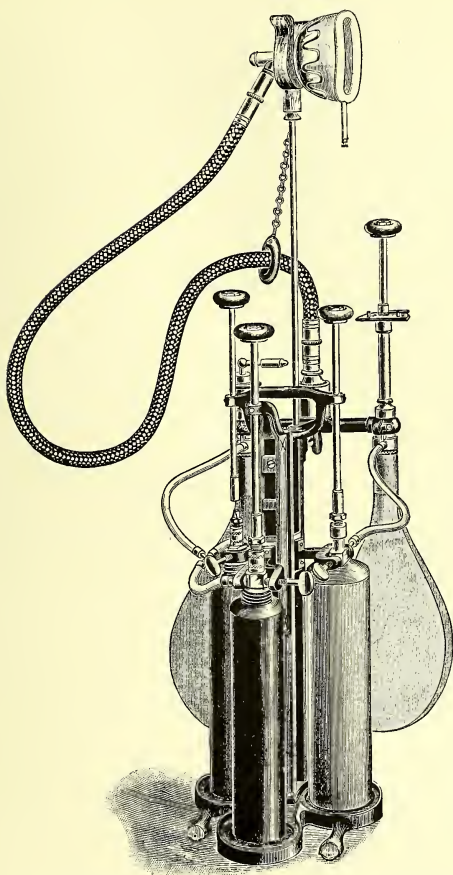


Fig. 27. Two-cylinder apparatus for administering nitrous oxide gas, with oxygen or ether.

operation. Preliminary treatment of this sort materially affects the after results of anesthesia.

The subject whose alimentary tract is not thoroughly emptied is very prone to nausea and vomiting—the principal effects we seek to avoid. The bowels should be thoroughly evacuated by mercurials. These agents promote the flow of bile which in itself is a frequent cause of vomiting when it is allowed to regurgitate into the stomach. No food should be permitted for at least six hours before the time of the operation and even then only that which is easily digestible.

*Special Requirements for Ophthalmic Surgery From the Viewpoint of the Anesthetist.* It is essential that we have (a) absolute immobility of the field of operation, (b) absence of coughing, straining, and vomiting following the anesthesia.

#### **Nitrous Oxide Gas.**

Statistics show this agent to be the safest general anesthetic, fewer fatalities having followed its use than that of any other.

Its anesthetic stage, however, is so short (forty to sixty seconds), that it is not practical for ophthalmic operations if it is used alone. Combined with other agents such as *oxygen* or ethereal vapor it acts admirably.

For this purpose one uses a two-cylinder apparatus (see cut) by means of which the flow of each gas may be regulated.

This method offers special advantages in that the nitrous oxide is first turned on and the patient is anesthetized, while any untoward symptoms arising from this agent are promptly relieved by the admission of the oxygen. Asphyxia may thus be avoided and no vomiting need occur. The exact amount of oxygen required cannot be estimated, each subject must be a law unto himself; the *pulse*, *respiration* and *color* of the patient must be the guides to safety.

Though a safe anesthetic, its use should be accompanied by the same careful attention as that given to any other agent.

Should perfect muscular relaxation be not obtained, as is frequently the case, the addition of a very little ether will bring about the desired result.

#### **Ether.**

In the hands of an experienced administrator this agent is also a safe general anesthetic.

If properly given the period required for the production of anesthesia is not long, although the time should not be considered when the safety of a patient is the chief consideration.

For short operations very little ether need be used, consequently little or no vomiting need occur.

The too common practice of "soaking" the patient is, in a large majority of instances, responsible for accidents.

*Method of Administration.* Many forms of inhalers are in the market, each advancing claims on the anesthetist. Whichever one is chosen, I believe ether should be given by the "closed" method, as the inspired air should contain not less than 80 per cent. of ether vapor.

I prefer a simple cone, made of folded newspaper or stiff cardboard, enclosed in a folded towel, pinned or sewed. This is converted into a hollow truncated cone with one side open. This answers the purpose satisfactorily. Should the admission of air be necessary on account of cyanosis, the cone may be opened at the top.

Absorbent cotton is put inside the cone at its closed end and the apparatus, *without any ether*, is applied to the patient's face.

After a few inhalations the cone is removed and a small quantity of ether is poured into the cotton, the cone is then gradually brought to the face and slowly placed in contact with it.

By this means the feeling of suffocation, and the consequent struggling and profuse secretion of mucus are avoided. The patient soon becomes accustomed to the odor and effects of ether, when the cone can be momentarily removed, a larger quantity of the drug added and immediately replaced. In this way one generally succeeds in minimizing the "stage of excitement" in ether narcosis.

When the patient is thoroughly anesthetized a very little ether is added from time to time to keep him properly and safely asleep.

"Soaking" the patient not only carries him into a dangerous state of coma but renders the onset of vomiting more certain, because of the increased amount of the agent to be eventually eliminated.

#### **Chloroform.**

This is the least safe of the general anesthetics and should never be administered by unskilled hands. If ether anesthesia is contra-indicated it may be used but only by an experienced administrator. It is probably less liable to be followed by vomiting or other untoward sequelæ than is ether but its dangers are greater and its administration calls for constant vigilance. It has, however, the advantage over ether of quicker action and smaller doses are required. Close watch must be kept of the pulse and respiration as very little or no warning is given of the approach of danger.

*Mode of Administration.* The Esmarch mask or a folded napkin may be used as the vehicle for this anesthetic. It should always be given by the "drop" method and with an open mask, as the inspired air should never contain above 5 per cent. of chloroform vapor; 3 per cent. would be much safer.

An empty mask is first applied and, shortly thereafter, a very few drops of chloroform are dropped upon it, gradually getting the patient accustomed to the odor and the interference with full breathing. Drop by drop and very slowly more chloroform is added until the patient is anesthetized with as little excitement as possible.

The pulse should be constantly watched; any change in its character should be regarded as a danger signal.

#### **Nitrous Oxide Gas and Ether Vapor.**

Some advantage is gained by this mixture; there is generally less struggling and as a smaller amount of ether is used vomiting and other disagreeable consequences are less likely to follow.

This combination should be given by means of a special apparatus a good example of which is the inhaler devised by Clover. This consists of a close-fitting face-piece, a cylinder of gas and a receptacle for the ether. (See illustration, page 148, Buxton's *Anesthetics*.) Gas can be given alone or, by means of a valve, may be turned from its direct course so that it passes *through the ether*.

The patient is anesthetized by gas alone and ether is then admitted. By this method vomiting is less liable to occur on account of the small amount of ether used for the complete anesthesia.

#### **A. C. E. Mixture of One Part of Alcohol, Two of Chloroform and Three of Ether.**

This inhalant is said to have an anesthetic action midway between ether and chloroform. There are some objections to this combination, but it is a good substitute when neither ether nor chloroform can, for any reason, be given alone.

In a mixture of anesthetics we are never certain of the rate of evaporation of the component parts; consequently we do not know how much of each of the drugs the patient is absorbing. I regard this uncertainty as a serious objection to the A. C. E. anesthetic.

It must be noted that there are few objectionable sequels from this form of general anesthesia.

The employment of morphia, atropia, chloral, scopolamine and similar drugs, either as direct anesthetics or as adjuncts to ether or chloroform, is rarely required in ophthalmic surgery.

#### **Ethyl Chloride.**

Rapid and complete anesthesia is produced by this drug, but if it be inhaled in large quantities or if air be excluded for even a few minutes, there is great danger of respiratory paralysis and failure of the heart's action.

Nausea and vomiting frequently follow its use so that it is not



well adapted to ophthalmic surgery. Moreover, it does not relax the muscles as well as ether or chloroform.

#### **Kelene, Narcotile and Anestile.**

These are substantially *ethyl chloride* or mixtures of it with *methyl chloride* (q. v.), and the remarks just made equally apply to these proprietary agents.

#### **Somnoform.**

This anesthetic preparation is a mixture of methyl chloride, 35 parts; ethyl chloride, 60 parts; ethyl bromide, 5 parts. In other words, it is a combination of three anesthetic drugs, each more or less dangerous, although it is claimed to be a safe and rapid anesthetic.

Its action is mainly that of ethyl chloride and if used continuously during a protracted operation or in large quantities may kill the patient by respiratory failure. It is not suitable for ophthalmic operations, as the ocular muscles (especially the powerful orbicularis palpebrarum) are among the last to yield to its influence and to become thoroughly relaxed. When this necessary condition is finally attained the patient has inhaled so much somnoform that he has entered the dangerous stage. Even then the duration of the anesthetic is not more than 90 seconds.

Vomiting is a frequent sequel, thus rendering it still more unsatisfactory for ophthalmic operations.

#### **Choice of Anesthetic.**

The routine practice of administering the same anesthetic in every operative case is to be condemned. Each patient should be considered by himself and the appropriate anesthetic employed.

No small factor in the selection of the anesthetic agent is the *experience of the administrator*. The skilled anesthetist knows that it is possible to avoid the dangers of a powerful anesthetic and to lessen the amount of the dreaded *nausea and vomiting*. *He also knows that by careful watching of his patient and not the operation or the operator*, how an objectionable anesthetic may be given without unduly jeopardizing life or the results of an important operative procedure.

In any event the choice of the agent must be decided according to the needs of the operation and the condition of the patient. The latter is determined by a previous careful and thorough inquiry (especially urinalysis, blood examination, auscultation and history) into the physical state of the heart, lungs, kidneys and other organs. *Lesions of any of the vital organs are taken as contra-indications to either chloroform or ether*. For example, myocarditis would contraindicate chloroform; bronchitis or destructive nephritis would interdict the employment of ether.

**The Administration of the Anesthetic.**

*Position of the Patient.* As a general rule the patient should be in the prone position, with the head on a level with the body.

A careful anesthetist will now note the anatomical build of his patient and will raise or lower the head as needs be. A short, thick-necked person must have the head lower than the body to allow of the free entrance of the air, whereas a long-necked individual will not breathe well if there is undue extension of the throat; consequently the head should be higher than the body level.

The *clothing* should be scant and loose about the neck; the *arms* either alongside of the body or flexed and held in this posture. The *head* should be turned to one side, to allow secretions to run either past the pharynx *into the stomach*, or out of the mouth, and so avoid coughing and the danger from asphyxia due to entrance of the secretions into the larynx.

The anesthetist does his work to better advantage, I think, if he stands at the side of the patient rather than at the head of the table. This position gives him a direct view of the patient's face; he is not obliged to pass the cone or anesthetic across the patient's eyes and he has better control of the situation generally.

**Method of Administration.**

As far as it is possible *the anesthetist should secure the confidence of the patient before giving the anesthetic*. Fear militates not a little against the ease with which the drug is given and taken. Assurances that no harm will ensue often calms the patient so that little or no struggling or excitement is attendant upon its administration.

*Ether.* This should always be given by the so-called "closed" method, i. e., the inspired air should contain not less than 80 per cent. of ether vapor.

**Dangers of General Anesthesia.**

These are (a) immediate, (b) remote. The *immediate danger is chiefly death*, due to paralysis of the heart in *chloroform anesthesia*. Here the drug acts directly upon the heart muscle through the coronary blood supply and it may take place in the first stage of the anesthesia. Later in the anesthesia it may kill by paralyzing the medullary centres. Death may also supervene in chloroform narcosis by paralysis of the respiratory centres, as in ether anesthesia.

Asphyxia may also be due to the entrance into the trachea of vomited matters, mucus or other foreign materials.

*Remote Dangers.* *Bronchitis* after the use of ether is not uncommonly noticed.

*Pneumonia* occurs after chilling of the surface of the body and

so lowering its resistance, or from the inspiration of vomited material.

The production, or recrudescence of a quiescent *nephritis*, due to the irritating effect of ether during the elimination of that agent by the kidneys is another and not extremely rare sequence.

*Paralysis.* Both central and peripheral pareses may follow general anesthesia. When central it is probably due to rupture or occlusion of a vessel, the result of sudden alteration in the cerebral blood pressure. Not much can be done, especially during the administration of the anesthetic, for such cases. When diseased cerebral vessels are suspected to exist the anesthetic employed should be one that induces the least rise in blood pressure, e. g., chloroform with oxygen.

*Peripheral paralyses* are caused by pressure on nerve trunks; for example, a brachial paralysis may follow if one arm be allowed to hang over the side of the operating table, or if forcible extension of the arm is made upwards.

*Glycosuria* and diabetic coma may follow anesthesia. Diabetics should be specially treated, if possible, before being anesthetized, and chloroform is the preferable agent.

#### **Accidents During Anesthesia.**

*Syncope, shock, mania, rigors* are not uncommon results of anesthesia. Treatment is indicated by each condition.

#### **Treatment of Accidents and Complications Attendant Upon General Anesthesia.**

*Chloroform syncope* usually appears at the very beginning of the anesthesia, although it may set in at a later stage. It may be due to reflex action on the heart through fear; deaths have been reported in patients who merely had the mask applied to the face without any anesthetic. It is probable, also, that the direct irritation of the vapor itself acting on the laryngo-pharyngeal mucous membrane may induce a syncopal attack; or, again, it may be due to the so-called "chloroform idiosyncrasy."

Beginning an operation before the patient is thoroughly anesthetized is prone to produce syncope through reflex action due to the shock of operating on still sensitive organs.

Treatment. The chloroform is at once removed, the head of the patient is lowered, and the legs raised to promote return of the flow of blood to the heart and brain. Complete inversion of the patient is most satisfactory. Artificial respiration is also in order. Injection, per rectum, of brandy in warm saline solution or hot beef tea is a valuable measure. Rapid percussion over the heart, rhythmic traction on the tongue, and intravenous injection of supra-renal extract are

effectual aids in the treatment of this accident. Inhalation of amyl nitrite is an excellent means of heart stimulation, as is, also, the direct application of the Faradic current.

*Ether accidents.*

*Immediate dangers* are interference with respiration or circulation, and the occurrence of vomiting. These are less to be feared than in chloroform narcosis.

*Remote dangers* arise from inflammatory affections of the mucous and serous coats of the respiratory tract and pleura; failure of circulation; rupture of blood vessels; kidney complications; continued vomiting.

Dyspnea may be met by raising or lowering (as may be indicated) the head, that free access of air may be obtained. Mucus collections should be removed from the mouth and pharynx.

*Disturbances of circulation.* These are to be treated by heart stimulants, as camphor in olive oil (a grain to the fluid dram), strychnia, digitalis, amyl nitrite inhalations, etc.

At times *vomiting* cannot be avoided, and is very persistent and annoying. Various means such as allowing the patient to inhale vinegar vapor, giving internally chlorotone (ten grain doses), an ice bag at the throat, or a sinapism over the epigastrium diminishes or checks this symptom.

We should see, when emesis sets in, that no vomitus enters the trachea.

*Respiratory troubles, such as bronchitis* and the so-called "ether-pneumonia," occur but if the ether has been properly given these complications are rare.

*Ether collapse* occasionally sets in after prolonged anesthesia, or if the operation has been a severe one.

For this complication the lower extremities should be raised and dry heat should be applied to the body.

*Renal complications.* Conflicting evidence has been given by various witnesses on this question. Nephritis, blood in the urine, and suppression or a decidedly lessened amount of urine have all been reported after ether narcosis.

Albuminuria is not infrequent and, if present before the anesthetic is taken, is usually afterwards increased.

*Careful administration* of the drug is not likely to be followed by either of these complications.

*Nausea and vomiting.* These are due largely to faulty preparation and overdosing of the patient with ether. Should they occur they may be relieved by sipping plain, hot water, iced soda-water, strong

iced coffee, or by the inhalation of the vapor from vinegar. Should vomiting persist good results often follow the ingestion of carbolie acid and wine of ipecac in one-half minim doses, repeated hourly.

*Death from ether anesthesia* is due to asphyxia from blood, vomited matter or foreign bodies entering the trachea, or from spasm of the chest muscles.

*Pulmonary complications in ether narcosis.* These are acute edema of the lungs, pleurisy with effusion, pneumonia, laryngeal diphtheria and emphysema.

To the foregoing may be added uremia from pre-existing nephritis.

#### **Ethyl Chloride.**

This anesthetic is not as safe as it is generally supposed to be. It is prone to cause embarrassed respiration, cyanosis, syncope, nausea and vomiting. These are usually brought about by over-dosing or on account of the impurities of the agent, a not infrequent condition.

Its action is evanescent in character and this fact, together with its not small dangerous character, renders it hardly suitable for ophthalmic surgery.

#### **Summary.**

All things considered, the safety of the patient, the length and character of the operation, the necessity for avoiding certain damaging sequelæ, the skill of the administrator, etc., one of the following agents should be chosen. They are listed in order of safety to the life of the patient:

1. Nitrous oxide gas and oxygen.
2. Nitrous oxide gas, oxygen and ether.
3. Nitrous oxide gas and ether.
4. Ether.
5. Chloroform.

It may be added that since ophthalmic operations are, on the whole, of short duration, *ether is a safe, reliable, convenient* and satisfactory anesthetic. If administered by a skilled anesthetist it may, as a rule, and with the exceptions noted, be chosen for the average occasion.

# CHAPTER XXI.

## REMEDIAL AGENTS EMPLOYED IN THE LOCAL TREATMENT OF EYE DISEASES.

*Abrin—Abrus Precatorius—Acacia—Acetozone—Acetic Acid—Acid Boracic—Acid Boric—Acid Carbolic—Acid Chromic—Acid Citric—Acid Bichloracetic—Acid Hydrochloric—Acid Hydrocyanic—Acid Iodic—Acid Lactic—Acid Monochloracetic—Acid Nitric—Acid Picric—Acid Salicylic—Acoïn—Actol—Adrenal—Adrenaline—Air—Adrin—Airol—Airoform—Albargin—Acid Tannic—Acid Trichloracetic—Albumen—Alcohol—Almond (Sweet) Oil—Alphozone—Alsol—Apyonin—Alum.*

The nomenclature employed in designating the chemical and other remedial agents described in the following chapters is somewhat mixed. The more familiar name of an agent, whether official or not, is set down in the following list in black-faced type. Synonyms are printed in italics.\* Unless otherwise stated the preparation of the United States Pharmacopeia is understood.

Certain outworn terms have been almost entirely abandoned; for example, *muriate* and *hydrochlorate* (for *hydrochloride*) to designate salts derived from the interaction of hydric chloride with a base (to use for the moment the older chemical theory) have been dropped. Complicated formulæ and polysyllabic designations, mostly derived from organic chemistry, have been omitted as of little or no practical value.

Although the incompatibles of the most important agents are set down in the following lists, nothing is said about antidotes to the poisons, since the toxicology of the subject is without the province of this work.

A separate heading is given to salts and compounds only when, by virtue of long or universal employment, they seem to require special discussion.

### **Abrin.**

This is the active principle of the jequirity bean, *Abrus precatorius* (q. v.). It is really a compound agent, composed of an albumose and a globulin, both of them poisonous. These may be separated from

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\*The reader who is unable to find the remedy he is in search of is referred to the Index where synonyms are alphabetically catalogued.



the bean by appropriate means. Any temperature above 122° F. weakens the action of abrin; exposure to a temperature of 185° F. destroys both component agents, the globulin being rendered inert at 176° F.

Abrin is used almost entirely in the treatment of chronic trachoma with pannus. Lapersonne (35) claims that a one per cent. aqueous solution produces the best results. After cocainizing the conjunctiva the internal surface of the upper lid is thoroughly rubbed with a cotton wad soaked in the solution. This is repeated on the second and (perhaps) following days. On examining cases months after a cure had thus been wrought by the drug the conjunctiva showed scars from the remedial inflammation. He re-echoes the claims of many writers that as a remedy for pannus in trachoma it is unequaled.

#### **Abrus Precatorius.**

*Jequirity. Prayer-beads. Crab's eyes. Love-peas.*

All the parts of this East Indian member of the Leguminosæ are distinctly poisonous. The seeds only are used in ophthalmic therapeutics.

Jequirity was first recommended by de Wecker in a half per cent. infusion for the treatment of trachoma and pannus. Infusions should be freshly prepared before use, as they readily undergo decomposition; or they should be made with a saturated solution of boric acid (four per cent.).

When instilled into the conjunctival sac it causes edema of the parts, followed by a serous and eventually a muco-purulent discharge. Swelling of the preauricular and submaxillary glands is frequently noticed, while corneal ulcer and even panophthalmitis have been recorded. For this reason *jequiritol* and the *jequirity serum* (q. v.) are safer and to be preferred when abrus preparations are indicated.

Masselon (34) reminds us of this ancient remedy for pannus trachomatosus, that it should be used only in those cases where granulations are unaccompanied by marked secretion; that it should never be applied where there is suppuration. It is especially indicated in old trachoma with pannus and sclerosis of the cornea; it should be *thoroughly pulverized* and applied to the conjunctiva with a camelhair brush, the lids being everted so that the cornea is protected. The powder is allowed to remain in contact with the lids two to five minutes, and is then brushed off. If the reaction is not marked, this application should be repeated next day. The subsequent inflammation should be treated by cold applications and mild antiseptic washes.

In America, Cheatham, many years ago, strongly advocated the use of this remedy, both powder and infusion, as the most efficacious agent we have for the clearing of pannus.

Rampoldi\* reports the successful treatment of several cases of *epithelioma* by the application of *jequiritin* (*abrin?*) in gelatine disk form.

J. P. Worrell (p. c.) has had a wide experience of *jequirity* in *intractable trachoma with corneal complications* and says that the results can be characterized by no other words than brilliant.

Lawson (*Text-book*, p. 537) gives the following *directions for making the infusion*. 100 parts of water at 120° F., are poured on eight parts of the powdered seeds. Stand until cool and decant. The seeds should be *fresh* and the *freshly-made infusion* is lightly scrubbed with absorbent cotton over both the lids and the cornea after cocaine [better, alypin or holocaine] has been instilled.

J. D. Seba (p. c.) has had much experience with and prefers the *freshly-prepared infusion of the powdered bean*. He begins with swabbing or flushing the everted conjunctiva with a mixture of a quarter of a grain of the powder to a drachm of distilled water. As soon as the jequirity conjunctivitis sets in the patient uses a simple borated wash every three or four hours. When the inflammation subsides he again applies the jequirity, increasing the strength of the mixture as much as is necessary to set up, again, a decided conjunctivitis.

In *old cases of trachoma* G. C. Savage (p. c.) has had marked results from the use of a *weak infusion* made from the powder of half a bean mixed in a fluid ounce of distilled water. To this infusion he often adds 20 grains of boracic acid. Into each of the diseased eyes two drops are put daily at bed-time and the action of the drug carefully watched. A fresh infusion should be made every two weeks and the use of the remedy continued until recovery is complete.

#### **Acacia.**

##### *Gum arabic.*

This is the dried exudate from various species of the leguminose acacia, obtained mostly from Egypt and the Soudan. It is seen in commerce in the shape of rounded tears or irregular fragments.

It consists chiefly of compounds of arabic acid with calcium and other bases. The adulterations are mostly starch and inferior or cheaper gums.

Gum acacia has a soothing action on mucous membranes and is generally employed as a *mucilage*. In this form it has an occasional use in burns of the eyeball from most agents. In the form of fine

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\*Rampoldi, *Annali di Ottalmologia*, 1907, p. 296.

*powder* it is occasionally used as a vehicle for other powders. It is now and then employed in collyria, as seen in the following formulæ:

℞

Zinci sulphatis	0.2 (gr. iij)
Aquæ dest.	12.0 (fʒ iij)
Mucilaginis gummi arabici	4.0 (ʒ j)
Tincturæ opii crocatæ	2.0 (f ʒ ss)

To be used once or twice daily.

℞

Camphoræ	0.40 gm. (gr. vj)
Lac. sulphur.	4.0 (ʒ j)
Aquæ calcarizæ	
Aquæ rosæ	āā 40.0 (fʒj-ʒij)
Acaciæ	0.8 (gr. xij)

Apply locally before retiring each night.

F. A. Morrison (p. c.) prefers the following formula as a *dusting powder in infected ulcer of the cornea*, to be followed by the use of a compress for a short time.

℞

Argyrol.	ʒ ss (2.00)
Pulv. acaciæ	ʒ iiss (10.00)

#### Acetozone.

##### *Benzosone.*

This compound, whose formula is  $(C_6H_5CO.COCH_3)_2O_2$ , occurs in colorless crystals that melt at  $98^\circ F.$ , and are soluble in 1 to 10,000 to 1000 of water (according to its temperature) and 35 parts of oil. It resembles hydrogen dioxide in structure and, like it, is a valuable *antiseptic*, *germicide* and *oxidizing agent*. It has been recommended in corneal ulcer, purulent blenorrhœa and gonorrhœal ophthalmia in watery or oily solvents, 1:1000 or stronger. Ointment of acetozone is available as strong as 1 per cent. although it is best to begin with a 1:1000 mixture.

J. G. Roberts (p. c.) uses this remedy in 1-1000 solution in *all purulent affections of the eye*, preceding operation and (in strength of 1-3000) to irrigate the anterior chamber during cataract extraction.

#### Acetic Acid.

$HC_2H_3O_2$  or  $CH_3COOH$ . The acid of common *vinegar*.

Almost all the acetic acid of commerce is obtained by the destructive distillation of wood, although domestic vinegar is derived from the acetous fermentation of grain.

Dilute vinegar is of some value in neutralizing burns of the con-

junctival sac and eyeball from caustic soda, potash and lime. Of course it should be applied at once, preferably warmed and used with an undine or medicine dropper to wash out the deleterious substances, at the same time converting them into less destructive compounds.

*Warts of the palpebral skin* may be removed by the application of the *glacial acetic acid*. This is an anhydrous, crystalline form of the acid which liquefies at 60 ° F. into a colorless fluid with a strong vinegar odor and a pungent, acid taste. It should be applied with care, as it is a powerful caustic and may involve a wider area than the diseased growths. For the removal of warty excrescences the fuming nitric acid (q. v.) is to be preferred.

G. C. Savage (p. c.) advises in *corneal ulcer* the application to the lesion of one drop of acetic acid in five to seven drops of water once in twenty-four hours. His method is to *touch the ulcer* gently with a piece of absorbent cotton (wrapped round a tooth-pick) and saturated with the above solution. The advantage of acetic acid over other agents is that while it destroys germs, as the other agents do, it does not destroy cell life, connective tissue or the epithelium.

#### Acid, Boracic.

*Boric acid.*  $H_3BO_3$  or  $B(OH)_3$ .

This acid was discovered in 1702 by Homburg and for over a century went under the name *Sal sedativum Hombergi* until its composition was demonstrated.

Its commercial origin is borax. It is obtained by treating that salt with hydrochloric acid and allowing the crystals to separate.

Boric acid occurs in white, translucent, six-sided, pearly scales that are greasy to the touch, odorless and of a slightly acid, acrid taste. It is soluble in 15 parts of alcohol, 4 parts of glycerine, 25 parts of cold and 3 parts of boiling water.

This agent is a mild and non-irritating antiseptic. A number of official and proprietary preparations are used in eye diseases. The chief of these is the *glycerite of boroglycerin*, U. S. or ointment of *boric acid*, Br. This form of the ointment is not so commonly employed as a simple mixture of the finely divided powder with vaseline or some similar excipient.

No remedy is as largely prescribed by the ophthalmic surgeon or so widely known to the laity as boric acid, with whom it has displayed, as a popular eyewash, many well authenticated virtues. This is doubtless due to its main qualities—that of a soothing detergent and mild antiseptic. In virtue of these actions it is utilized alone and in combination with other drugs, in solution, as an ointment and in the form of powder.

In solution it is prescribed in strengths varying from  $\frac{1}{2}$  per cent. to the point of saturation (4 per cent.). These mixtures are used for sub-conjunctival injections (generally 2 per cent.), sprays (1 per cent. to 3 per cent.), douches (2 per cent.), large irrigations (1 per cent. to 4 per cent.), and as hot or cold compresses (1 per cent.).

One of the most effective (because both soothing and mildly anti-septic) collyria I know of is the combination with borax and corrosive sublimate:

R

Sodii boratis	
Acid. boric.	2.00 (3 ss)
Sol. hydrarg. bichlor.	
1-10,000	60.00 (f3ii)

This solution is intended for use in all forms of hyperemia of the conjunctiva and the less severe forms of conjunctivitis where a non-irritating, antiseptic and cooling wash is indicated. It may also be used, like the simple solution, in the irrigator and undine for washing out, disinfecting and removing toxins, mucus, and other discharges from the conjunctival sac. Of the numerous combinations so widely prescribed as simple collyria the following is also a fair sample:

R

Acid. boric.	2.00 (3 ss)
Aquæ amygdal. amar.	40.00 (f3ii)
Aquæ rosæ	100.00 (3iii)

Boric acid is also a (weak) preservative of alkaloids and other compounds prone to decomposition. For this purpose it should be used as a saturated solution.

Boric acid is often used in ointments, in which case petroleum or yellow vaseline furnishes a good excipient. I can see no reason for prescribing in salves a larger proportion of the acid than one or two per cent. as even less than that amount is soluble in the water of the vaseline or in the secretions of the eye. Much larger quantities (5 to 25 per cent.) are, however, recommended for various complaints. Rabow, for example, has this formula, a 10 per cent. mixture:

R

Acid. boric.	5.0 (3j gr. xv)
Lanolini	20.0 (3v)
Petrolati	30.0 (3j)

When applied in ointments only the finest powder should be used and all the constituents thoroughly mixed. In my judgment, boracic

salve is an inferior form of ointment and is not the equal of other preparations of the kind.

As a *finely divided, dry powder* boracic acid has been applied to the conjunctivæ and to the dermal surface of the lids as an antiseptic and protective. When the powder is of the impalpable variety it answers the purpose very well since it is free of odor, does not irritate and is not likely to "cake." At the same time it is questionable whether it takes the place of calomel and iodoform in most of the uses to which these remedies are put. For dusting on the conjunctiva and palpebral skin it is occasionally combined with iodoform:

R

Pulv. iodoform,	10.00 (3iiss)
Pulv. acid. boric.	1.00 (gr. xv)
Mix in a mortar.	

**Acid, Boric.**

(See *Acid Boracic.*)

**Acid, Carbolic.**

(See *Phenol.*)

**Acid, Chromic.**

*Chromium trioxide. Chromic anhydride.*  $\text{CrO}_3$ .

This agent, obtained by the action of sulphuric acid on potassium dichromate, occurs as small, purplish needles of a metallic lustre. They are odorless, deliquescent in moist air and very destructive of animal tissues. It is very soluble in water and decomposes in the presence of ether, alcohol and glycerine. It fuses at  $380^\circ \text{F.}$  into a glass-like, black mass. The watery solution is of an orange color.

As a caustic application to *corneal ulcer* this agent is of considerable value. The acid, fused on the tip of a silver probe, should be carefully applied to the cocainized eye so as to destroy as little as possible of the healthy tissues. The ulcer must be previously stained with fluorescein and afterwards gently irrigated with a 2 per cent. sodium chloride solution. The crystals, applied by means of an iris forceps, are also used in Hungary for the removal of trachoma granules, the cauterization being followed by immediate cleansing with sterile water.

**Acid, Chrysophanic.**

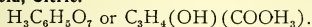
There are two forms of this acid; a so-called "medicinal" acid, better known as *chrysarobin*, also called *purified Goa powder*, a substance deposited in the wood of *Vouacoupoua araroba*. Chrysarobin is an orange-yellow, crystalline powder, turning brownish on exposure and yielding true chrysophanic acid on oxidation. In the form of powder it is exceedingly irritating to the eyes and if allowed to enter



them may set up a violent kerato-conjunctivitis. As an ointment, 1 to 3 per cent., it is occasionally used in palpebral eczema.

The second form of this acid is *rhein* or *rhubarb-yellow*, the coloring matter of *Rheum officinale*. It closely resembles *chrysarobin*, and like it, is prescribed in diseases of the lid skin in 2 to 5 per cent. salves. The powder (yellow, microscopic crystals) should be kept from the eyes and not exposed to light.

#### **Acid, Citric.**



The acid of lemon and lime juice is made in large quantities from these and other fruit juices, as well as from grape-sugar. It crystallizes in colorless prisms of an agreeable, acid taste. It is very soluble in water and alcohol. Its uses in diseases of the eye are quite limited.

Although citric acid is rarely employed as a topical remedy, *lemon juice*, substantially a dilute form of the acid, has been recommended in several pathological eye conditions. For example, de Schweinitz (*Text-book on Diseases of the Eye*) mentions it as one of the local applications to the exudate in *diphtheria of the conjunctiva*. In this and similar affections the fresh juice is said to be preferable to dilute solutions of the acid or of the citrates.

Simi, of Florence, has advised the instillation of a strong (50 to 75 per cent.) solution of this drug as an absorbent in *nebulæ* and *leucomata corneæ*. He claims that, dropped into the sac daily for a number of months, it will accomplish the purpose in the majority of cases. I have had no experience with the remedy.

#### **Acid, Dichloracetic.**

*Bichloracetic acid. Urner's liquid chloracetic acid.*  $\text{C}_2\text{H}_2\text{Cl}_2\text{O}_2$ .

A colorless liquid, soluble in water and alcohol.

Like the other chloracetic acids it acts well when applied undiluted as an escharotic for the removal of warts and other growths from the lids. In *corneal ulcer* (q. v.) it has been found very useful as a cauterant, applied by means of a tooth-pick soaked in it, after staining and cocainization.

#### **Acid, Hydrochloric.**

*Muriatic acid. Hydroic Chloride.*  $\text{HCl}$ .

This valuable article of commerce is made by the action of sulphuric acid on sodium chloride. The official acid is a colorless liquid, emitting white vapor when in contact with the air. The strong acid is a powerful escharotic and poison. It should be applied to the human tissues with great care.

As a cauterizing agent in *corneal ulcer* this acid has been used in 10 to 20 per cent. watery solution, but in my judgment it is more likely

to damage the surrounding tissues than most other applications. Birnbacker (55) recommends, for the *removal of calcareous deposits in the cornea*, that the chalky infiltration be touched with a 5 per cent. solution which should be at once neutralized by the same strength of sodium carbonate.

#### **Acid, Hydrocyanic.**

*Prussic acid. Dilute hydrocyanic acid.* HCN.

The dilute acid of the U. S. P. contains about 2 per cent. of the strong, anhydrous acid and is a colorless liquid, having an odor of oil of bitter almonds. It occurs in the free state in the various almond trees, the cherry laurel (q. v.) and in other plants. It is a rapid and powerful poison for which there is no competent antidote.

Instead of using *cherry laurel water* some ophthalmic surgeons prefer a collyrium made up with *dilute hydrocyanic acid*, of which the following is a fair example, useful in *conjunctival hyperemia*:

R̄

Acid. hydrocyanic. dil.	gtt. i
Acid. boric.	̄ ss.
Sod. boratis.	gr. xl
Aquæ dest.	fl. ̄ii

Lawson (*Text-book*, p. 538) suggests the following as a *soothing application to the conjunctivæ*:

R̄

Ext. opii. liq.	fl. ̄i
Acid. hydrocyanici. dil.	m. xxx
Aquæ dest. ad	fl. ̄viii

#### **Acid, Iodic.**

HIO<sub>3</sub>.

Iodic acid is found as colorless, rhombic crystals, soluble in one part of water but less soluble in alcohol. It forms numerous iodates, some of which are important and are detailed here.

This remedy has been employed as an application in *trachoma* and other eye diseases, in the form of *pencils* and has been made up for that purpose in sticks containing 15 per cent. of the pure acid. In from one to three per cent. solutions it is recommended as a collyrium in *indolent corneal ulcer*.

In *trachoma*, where lunar caustic or copper sulphate pencils are contraindicated, Schiele strongly advises the use of the *solid stick* and claims that it does not produce scarring.

#### **Acid, Lactic.**

HC<sub>3</sub>H<sub>5</sub>O<sub>3</sub>.

This acid, obtained from cheese, sour milk, "sour-kROUT" factories

and other sources, is a syrupy, odorless, colorless fluid, of a strongly acid taste. It mixes in all proportions with water.

As a *cautery in rodent and other ulcers of the cornea* it has been used to advantage although, in my experience, it is not equal to phenol or the actual cautery. Dolschenkow (58) recommends it for this purpose, diluted one-half with water. It is applied by means of a pointed glass rod or with a wooden toothpick soaked in the fluid.

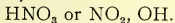
#### Acid, Monochloracetic.



This is a very deliquescent, colorless, crystalline mass. It is decidedly caustic and cauterant and should be handled with care. It is very soluble in water and is generally applied as an escharotic, almost pure, to warts and other growths. It is also employed like *trichloroacetic acid* (q. v.), in 50 per cent. solution to corneal ulcers.

S. B. Muncaster (p. c.) advises the use of *monochloracetic acid* for the *removal of xanthoma* (q. v.). A solution of one part to two of water is applied by means of a piece of cotton on the end of a tooth-pick. In a few seconds after the application the yellow discoloration becomes white; on the second day there is swelling; in about a week a scab forms and falls off, about ten days thereafter, leaving a clean surface without any scar. In some cases it is necessary to make a second or, perhaps, a third application at intervals of four to six weeks.

#### Acid, Nitric.



Pure nitric acid is a colorless, fuming liquid, staining animal tissues yellow. The so-called "fuming nitric acid" is of a brown-red color, emitting suffocating vapors of the same color. All the strong acids are powerful cauterants and poisons.

The "fuming" acid forms an effective *escharotic for the removal of palpebral warts*. When properly applied there is little or no scarring and the method is decidedly superior to the use of cutting instruments, glacial acetic acid, citric acid and the like. The papilloma should first be well disinfected and dried. Soak a match or wooden toothpick in the acid and remove all excess of fluid with blotting paper. Carefully tattoo the top of the wart with the wooden point. Some burning follows that soon subsides. At each application, which may be made every two or three days but only when there is no soreness, repeat the disinfection and drying of the growth until the wart dries up or crumbles away.

Solitary "wild hairs" may be effectually destroyed by first enlarg-

ing, with the aid of a loup and the end of a sharp-pointed hardwood toothpick, the hair follicle and thrusting into the opening the same toothpick subsequently soaked in strong nitric acid. The preliminary boring is made by a careful rotary motion of the wooden "drill." There is no bleeding; pain is prevented by cocainizing the eye and the globe is protected by thoroughly swabbing the lid after this procedure with a 5 per cent. solution of soda. The eyelash generally drops out within 24 hours and if the operation is skilfully performed the follicle is entirely destroyed at one sitting.

Some surgeons use 5 per cent. to 10 per cent. solutions of nitric acid for cauterizing corneal ulcers, but I much prefer other agents as less painful and quite as certain.

#### Acid, Picric.

*Carbazotic Acid. Picric Acid. Trinitrophenol.*

This agent is obtained by the action of nitric acid on such organic compounds as salicin, indigo, etc., and occurs as inodorous, yellow needles of an acid, bitter, acrid taste. It forms a bright yellow solution in 90 parts of water—more soluble in ether and alcohol.

It is incompatible with all alkaloids, is explosive with sulphur and phosphorus and is a deadly poison. It stains all tissues a bright yellow and is rarely used in ophthalmology.

A *saturated aqueous solution* is used by E. M. Alger (p. c.) in *burns of the lids* and *herpes zoster ophthalmicus*.

With some surgeons picric acid is a favorite remedy for painting the lid edges in *ulcerative forms of blepharitis*. For this purpose it is used as a 1 per cent. solution, afterward wiping it off with a cotton swab dipped in a 5 per cent. salt solution.

Salem advises the use of picric acid lotion in the treatment of blepharitis, acute infective conjunctivitis, phlyctenular disease of the conjunctiva and cornea, trachoma and ophthalmia neonatorum. He employs the following collyrium:

℞	
Acid picric	0.10
Glycerin.	
Aquæ dest.	āā 5.00

Businelli and A. Fortunati\* found that picric acid may be used with advantage in *burns of the eyes, from fire or chemical substances*. It is said to be of special benefit in burns produced by quicklime. For this purpose the following ointment may be applied two or three times a day:

\**Bolettino dell' ospedale oftalmico della provincia di Roma*, Oct., 1907.

R̄

Acid. picric.	0.20 (gr. 3)
Vaselin. alb.	10.00 (gr. 150)

A little cocaine solution may be instilled previously, to prevent pain.

### Acid, Salicylic.

*Ortho-oxybenzoic acid.*  $\text{HC}_7\text{H}_5\text{O}_2$ .

Although salicylic acid occurs free and in combination in the flowers and leaves of several plants it is mostly prepared from phenol. It occurs as small, white, odorless needles, of a sweetish astringent taste, slightly soluble (1:450) in water, but very soluble in alcohol and ether. It is a local antiseptic and astringent.

Of all the willow compounds this agent, among the earliest and most frequently used, is now rarely heard of in ocular therapy. It is not so well borne internally as aspirin, salicin or its sodic and potassic salts, and locally is more irritating than sodium salicylate (q. v.). Hirschberg is not enthusiastic over its local employment. Fick has recommended a salve formula with zinc oxide in which some zinc salicylate is probably formed.

R̄

Zinc. oxid.	1.00 (gr. xv)
Acid. salicylic.	0.1 (gr. iss)
Vasellini	10.0 (ʒiiss)

He uses this in the squamous form of blepharitis.

As a disinfectant lotion for use with Anel's syringe in *lachrymal infections* the following prescription may be employed:

R̄

Acid. boric.	10.0 (ʒiiss)
Acid. salicylic.	2.5 (gr. xxxviii)
Aquæ dest.	500.0 (Oj)

E. M. Alger (p. c.) uses the following prescription in the scaly forms of blepharitis:

R̄

Acid. salicyl.	gr. v,
Hydrarg. ox. flav.	gr. i-v,
Petrolati ad.	ʒss.

In Germany it has been prescribed in one per cent. solutions as a collyrium in *simple catarrh of the conjunctiva* (and in xerosis) with warm chamomile tea as a solvent. It is also the active ingredient in Sattler's solution (q. v.)

**Acid, Tannic.**(See *Tannin*.)**Acid, Trichloracetic.**

This agent is prepared by the action of nitric acid on chloral. It is found as colorless, rhombic crystals that are very deliquescent, possess a weakly pungent odor and are very soluble in alcohol and water.

It is an effective *cauterizing agent for corneal ulcers, to be applied pure on the end of a wooden toothpick or pointed match soaked in it, any excess of acid to be removed from the applicator before the cautery is begun. It forms an effective agent in the removal of warty growths from the lids, producing a dry eschar that falls off in a few days leaving a smooth surface.*

In *diplobacillary infections of the cornea* Homer E. Smith (p. c.) has used locally a 20 per cent. solution of this remedy associated, of course, with other treatment.

**Acoin.**

This local anesthetic and substitute for cocaine is a synthetic hydrochloride of *dipara-anisyl-mono-phenetyl-guanidine*.

It produces local anesthesia about as quickly as cocain or eucain but it is much more irritating than either of these remedies. On the other hand it does not increase the intra-ocular tension, dilate the pupil or paralyze the accommodation. It is commonly used in 1:300-400 solution. It is said to be more satisfactory than cocain for subconjunctival injections.

From the experiments of Randolph (32) and Hirsch (33) we know that acoin is a satisfactory substitute for cocaine in certain cases.

It is claimed that mixtures of acoin and cocain act much more satisfactory as anesthetics than either agent alone. For instance, Krauss (16) speaks very enthusiastically of acoin-cocain anesthesia and advises this formula:

℞

Acoin.	0.025 (gr. 0.4)
Cocain.	0.05 (gr. 0.833)
Sol. sod. chlor. (0.75 per cent.) ad.	5.0 (gr. 75)

C. Barck (p. c.) employs the following subconjunctival injection when indicated:

℞

Acoin.	
Potassii iodidi.	āā 0.15
Aquæ dest.	15.00



It is painless, not irritating and its absorption into the interior of the globe has been proved by von Pflugk.

He strongly recommends a *one per cent. solution of acoin in oil* as the *best analgesic* for painful eyes from any cause. It is non-irritant and a few drops relieve the pain for several hours. The mixture is also non-toxic and does not affect the cornea, the accommodation, the pupil or the intraocular pressure. He has used it in hundreds of miscellaneous cases and it has never disappointed him.

#### Actol.

*Silver lactate Aktol.*  $C_3H_5D_3 Ag$ .

It occurs as brownish or colorless, acicular crystals, soluble in 15 parts of water and easily affected by light.

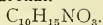
This is one of the best of the germicidal inorganic silver salts used in ophthalmic practice and was introduced by Credé. It makes satisfactory antiseptic solutions, as for instance in the drying and sterilizing of catgut sutures, and is employed as a substitute for silver nitrate in solutions of 1:500 to 1:2000.

#### Adnephryn.

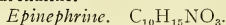
This is the trade (Stearns) name of a preparation that *closely resembles adrenalin*, suprarenalin and similar extracts of the suprarenal gland. It occurs in the market in the usual 1-1000 solution, as well as in the form of oil spray, emollient, suppositories, etc. From my experience of it, it appears to be a *reliable vaso-constrictor* and to be useful in all those ophthalmic operations and eye diseases for which suprarenin, etc., are advised.

#### Adonidin.

This local anesthetic was first employed as a substitute for cocaine but there are too many disadvantages encountered during its employment. At least one per cent. strength is required to anesthetize the anterior ocular segment. Two drops of this solution instilled during five minutes produces complete anesthesia after 25 minutes, but it also sets up almost at once a marked reaction, headaches, cloudy vision, conjunctival hyperemia and a bitter taste in the mouth. Tension and accommodation are not affected but it acts as a mild miotic and analgesic. Schiedlowsky demonstrated its therapeutic value before the St. Petersburg Ophthalmological Society in November, 1906, and showed that while adonidin has not much practical value as a local anesthetic it promptly *relieves the pain in glaucoma, iritis and iridocyclitis*. For this purpose one-quarter of one per cent. solution is sufficient and, like dionin, whose action it resembles, it may be used in conjunction with eserine, pilocarpine, atropine or any other of the miotic or mydriatic alkaloids.

**Adrenal.**

This is a *crystalline base* from the *suprarenal capsule* and belongs to the same category as *suprarenine*, (q. v.) *suprarenaline*, *adrenaline* and other hemostatics of that order. Although it is not readily soluble in water its salts are. It is used in 1:10,000 to 1:1000 solutions.

**Adrenaline.**

This remedy is a crystalline substance isolated in 1901 by Takamine and Aldrich in the suprarenal body of the ox. It is a grayish-white, minutely crystalline substance, having a bitter taste and imparting a numb feeling to the tongue. It is very soluble in hot, but less so in cold water. Even the 1:1000 preparation of Parke, Davis & Co. turns pinkish on exposure to air and light, but this change does not affect its activity.

Although a number of preparations derived from the suprarenal capsules are on the market, this remedy, especially as adrenaline chloride (preserved by the addition of 0.05 per cent. of chloretone), in solutions of 1 to 1000-5000, seems still the favorite, its action being substantially that of other adrenal agents. Cocaine seems to reinforce its astringent or blanching action, thus making it a valuable adjunct in operating on the eyeball.

In a few minutes after the use of the solution the conjunctiva turns marble white, the tissues at the inner canthus shrink and the palpebral conjunctiva becomes pallid. A few more instillations and the lid skin begins to whiten and in some patients this pallor extends quite to the cheeks, the nose and the eyebrow. Some surgeons claim that post-operative bleeding in such procedures as the advancement of an ocular tendon is more marked than when no suprarenal agent is employed, but as a clear field during the operation is the all-important consideration and the subsequent bleeding of small moment, the postoperative hemorrhage may be ignored.

Many suprarenal gland extracts are almost *identical* chemically, physiologically, and clinically *with adrenaline*. They are supplied to the profession by various manufacturing chemists in this country and abroad. Most of these hemostatics will be more or less fully described under separate headings. A few of the recent ones are *hemisine*, *renaglandin*, *suprarenin*, *adnephrein*, *paranephrein* and *renostyptin*.

Sydney Stephenson (*Ophthalmoscope*, Oct., 1908) believes that adrenaline is of no value in the *treatment* of superficial eye diseases, although it has been of service in *glaucoma* and *spring catarrh*. On the other hand it is most valuable as an *adjuvant* to atropine, eserine and

fluoresceine and as a *local hemostatic* in operations on the eye, especially on the eye muscles.

Darier (*Thérapeutique Oculaire*, p. 152) uses the following mixture with cocaine (which he calls *coca-renaline*):

R

Cocain. hydrochlor.	0.10
Sol. adrenalin. (1:1000)	gtt. 20
Aquæ dest.	10.00

A single drop of this collyrium is sufficient to blanch the conjunctiva and dispel all scleral congestion. He has found it of great service to actors and others who feel obliged to appear with their eyes as brilliant as possible and the sclera as white as it can be made. With this mixture the desired result is obtained without dilating the pupil.

A. Duane (p. c.) believes that its use is indicated in *engorgement of the conjunctival and scleral vessels* and the feeling of irritation accompanying that condition, but does not think the remedy should be applied for any length of time and that this method of utilizing it is not justifiable except in cases of lachrymal diseases and in some examples of spring catarrh.

Under the name *codrenin* (q. v.) a mixture containing 4-5 grains of cocaine hydrochlorate, 1-12 grain adrenaline chloride and 2¼ grains chloretone is for sale that seems well adapted for subconjunctival use. See, also, *suprarenal extract*, *suprarenaline*, *adrim* and *supra-renin*.

#### Adreucaine.

A preparation similar to *eudrenine* (q. v.). It is suitable for ordinary hypodermic use in inducing local anesthesia. Each cc. contains 1/6 of a grain (0.01 gm.) of *eucaïne* with *adrenaline* 1/2000 grains (0.03 mgr.). The *hypodermic dose* is ½ to 1 cc. When this mixture is diluted with four volumes of normal salt solution it forms an injection suitable for *local infiltration-anesthesia*.

#### Adrovaine.

This is another compound of a *hemostatic with a local anesthetic* and contains *adrenalin* 0.00025 gm. (1/250 grain) with *stovaine* (q. v.) 0.02 gm. (1/3 grain). It may be used with the hypodermic syringe or dissolved in sterile water as a local application in operations on the eye.

#### Air.

*Atmospheric air.*

As is well known our atmosphere contains, by volume, *free oxy-*

gen, 21 parts, *carbomic dioxide* 0.03 parts, watery vapor and a small percentage of other gases and floating impurities, all largely diluted with free nitrogen, 78 parts. What influence, if any, is exerted by these gases in the rare uses made of air in ophthalmic therapy is unknown.

A current or *blast of hot air* (See *Heat*) is recommended by some surgeons for the relief of *iritis*, *glaucoma*, *corneal ulcer* and other painful diseases of the eye but in all of them it is probably the heat that is the essential factor in this treatment.

Koster has recommended *intraocular injections* (q. v.) of *sterile air in tubercle of the iris*, ciliary body and choroid tract. Later, Terson suggested the *subconjunctival use* (q. v.) of sterilized air in *corneal ulcer* and other external diseases of the eye.

Caralt\* has made use of *subconjunctival injections of sterile air* in many ocular maladies. He believes their action to be due to an increased leucocytosis, set up by the presence of oxygen in the subconjunctival tissues, and feels justified in making the following conclusions:

The injections are harmless, painless, analgesic, and remove adhesions of the subconjunctival space. They stimulate leucocytosis, and hasten the removal of the products of inflammation.

They have little or no antiseptic power, and are therefore inferior, in presence of virulent infection, to the injections of mercurial solutions.

Their lymphogogic and osmotic power is less than that of injections of sodium chloride, and the latter should be used in intraocular infections.

In *scleritis*, and *sclerosing keratitis*, and also in *tuberculous and filamentary keratitis*, they are the treatment of election.

They seem to be specific in tuberculous iritis.

They are the best treatment known in hypertrophy of the limbus in spring catarrh, and in bulbous keratitis dependent on herpes or traumatism.

They are of value as an adjuvant method in various forms of ulcer.

In sterilizing air it is only necessary to draw it into the container (generally the barrel of a syringe) by placing the needle point in the center of a good-sized alcohol flame and "sucking" the air through the flame while slowly withdrawing the piston.

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\*Review in *Ophthalmoscope*, July, 1908.

# **Adrin.**

By this trade name is known *epinephrine hydrate*, one of the numerous *suprarenal capsule extracts*. It is probably identical with *adrenalin chloride* (q. v.) and is used in the same dose, as a hemostatic and astringent.

# **Airoform.**

(See *Airol*.)

# **Airol.**

*Airoform. Bismuth oxyiodo subgallate.*

It is a light, odorless, tasteless, grayish-green powder slowly changing to red on exposure. It is insoluble in water or alcohol, contains 24 per cent. of iodine, is used as a *substitute for iodoform* and has been employed as a 10 per cent. ointment, which must be free of water which decomposes it.

Airol is used in the treatment of both *infective and interstitial keratitis*. As a substitute for iodoform it is also useful as a dry dressing in *plastic operations on the lids* and as a disinfectant dusting powder in the treatment of corneal ulcer.

# **Albargin.**

*Gelatose silver.*

Coarse, yellowish, shining powder, very soluble in water; is a compound of silver nitrate with gelatose, containing 14 per cent. of silver. It is found in the market only in the form of 0.2 gm. (3 gr.) tablets.

In the absence of distilled water, dilute solutions of albargin may be made with the ordinary water supply. It is advisable, however, to prepare concentrated and stock solutions with distilled water and to protect them from light by storing the solutions in brown glass bottles. To dissolve albargin even boiling water may be used without decomposition as is the case with other albumen compounds of silver. If ordinary spring water is employed it should be added gradually to the albargin with occasional shaking, as with the contrary order turbidity may be caused; when distilled water is used however such a precautionary measure is not necessary.

Albargin stains on clothing are easily washed out with soap and water when fresh. Old stains, which have been exposed to light are easily removed with hyposulphite of sodium by steeping the articles of clothing in a *warm* 10 to 20 per cent. solution until the stains have disappeared.

For treatment of the eye 10 to 20 per cent. *albargin solutions in glycerine* are used. Twenty per cent. albargin glycerine solutions are also sold under the name of "Prophylactol."

This silver compound is regarded by Barnemann (36) and others as superior to all other argentic salts in the treatment of infectious

diseases of the eye. It is non-irritant but soon kills the various pathogenic cocci. It dies not decompose on exposure to light and its solution gives a neutral reaction. It is used in 2 per cent. solutions wherever silver nitrate or protargol is indicated. It is sold in 3-grain tablets, 50 in a glass tube.

A. C. Bartholomew (p. c.) finds this silver albuminate less irritating than and quite as satisfactory a germicide as argyrol and protargol.

#### Albolene.

A bland excipient of the *vaseline* class, marketed as a proprietary remedy and sold both in the liquid and solid forms.

H. McI. Morton (p. c.) in all affections of the eye with secretion uses the following application at night time along the interpalpebral margin *to prevent adherence of the lids and so permitting drainage of the sac*:

R

Acid. boracic.

gr. x.

Albolene (solid.)

ʒiv.

#### Albumen.

*White of Egg.*

There is also *dried egg albumen*, official in the P. G. as *albumen ovi siccum*; serum or *blood albumen*; *Tata-albumen*, a translucent, gelatin-like modification of egg albumen and "Tropon," a proprietary powder said to contain 90 per cent. of albumen.

Among the few uses of this agent in ocular therapeutics is in making *alum* (q. v.) and *copper sulphate* curds (q. v.) or *poultices for recent ecchymoses, acute conjunctivitis and the bites and stings of insects, ulcerative blepharitis and other diseases of the lids.*

#### Alcohol.

*Ethyl alcohol. Spirits of wine.*  $C_2H_5HO$ .

Commercial alcohol contains varying proportions of ethyl alcohol from 95 per cent. in alcohol, U. S. P., 90-95 per cent. in *cologne spirits*, to 50 per cent. in *proof spirit* and other mixtures.

In addition to the use of this remedy as a disinfectant of instruments, for the hands of the operator and the dermal field of operation, it is by some surgeons added in small quantities and for its stimulating qualities, to sprays, douches and even to collyria. Probably a number of popular and proprietary remedies owe their value to the slightly disinfectant and vascular tonic effects of the alcohol (and essential oils) in these preparations. In this way I have known Bay Rum, French brandy, Rose water, Violet water, Eau de Cologne, Spirit of Lavender, Spirit of Camphor, Whiskey and other alcoholic



fluids used in the proportion of 1:100 to 200, with relief in simple hyperemia of the conjunctivæ. They are generally presented as aqueous collyria in, say, a teaspoonful to a pint of warm, boiled water. Doubtless, also, the remedial effects of that popular remedy Pond's Extract (tincture of hamamelis) is mostly due to the alcohol it contains.

German oculists frequently order stimulating eye waters containing 5 to 10 per cent. of a useful alcoholic *mistura oleoso-balsamica*, official in their pharmacopeia. Its formula is:

℞	
Acid. boric.	2.25 grm. (gr. xxxiv)
Aq. amyg. amar.	5.0 c. c. (f5jmxv)
Aq. rosæ.	100.0 c. c. (f5iii, f5j)

Ohlemann (53) gives several alcoholic prescriptions suitable as eyewashes, douches and collyria in simple hyperemia and conjunctivitis. Among them are.

℞	
Hydrarg. bichlor.	0.02 grm. (gr. iii)
Aq. foenicul.	
Aq. Rosæ āā	25.0 gm. (f5vi)
Misturæ oleoso-balsamica	100.0 c. c. (f5iiiiss)

Sig. Use a teaspoonful to a glass of water.

℞	
Spt. melissæ co.	100.0 c. c. (5iiiiss)
Spt. lavandulæ	25.0 c. c. (f5vi, mxv)
Spt. camphoræ	3.0 c. c. (mxlv)
Spt. ether nit.	2.6 c. c. (mxl)
Olei rosæ	0.1 c. c. (mjss)

Sig: Eye Spirits—to be rubbed into forehead and temples.

℞	
Mist oleoso-balsamicæ	10.0 c. c. (f5ii, mxxxiv)
Spt. lavandulæ	20.0 c. c. (f5v, mviii)
Aq. foeniculi	70.0 c. c. (f5ii, 3ii)

Sig: Eye drops.

Mittendorf recommends an alcoholic mixture under the caption *Spiritus Ophthalmicus*, which I, from personal experience, find of considerable value. It is intended to be well rubbed into the eyebrows, forehead and temples for the relief of ocular headache and other reflex asthenopic symptoms. The formula is:

℞	
Spirits of lavender,	
Brandy, of each 3 fluid ounces,	
Spirits of camphor, 1 fluid ounce.	

I have also found effective, employed in the same way:

R

Chloroform.	f̄j
Camphoræ	̄ii
Tr. aconiti	f̄ii
Ol. menth. pip.	mxx
Alcohol.	f̄ii

Sig: Shake well and apply every two or three hours. Do not allow any of the liniment to get into the eyes.

Alman has published a paper favorable to the use of alcohol compresses in the treatment of eye diseases. Recently it is also recommended as hypodermic injections in supraorbital and other forms of neuralgia.

#### Almonds, Sweet, Oil of

*Expressed oil of almond. Oleum amygdalæ expressum. Almond oil.*

This is the fixed oil expressed from the kernels of *Prunus Amygdalus*, bitter or sweet. It should be nearly colorless, odorless and with a nutty taste. It is slightly soluble in alcohol; very soluble in ether and chloroform. The pure oil consists mostly of triolein with some tripalmitin.

The pure oil makes a good base for eye ointments, especially when mixed with "cold cream," paraffin, wax or other firmer excipient. As a solvent for such alkaloids as atropia, cocaine, eserine, etc., it is probably inferior to castor oil or even olive oil. Like other oils it may be employed as an antidote in burns by lime and strong alkalies. See, also, *aqua amygdalæ amara*.

#### Alphozone.

*Succinyl peroxide.*

A whitish powder, soluble in 30 parts of water, and presented as a germicide and antiseptic and used as such both externally and internally.

F. B. Eaton (p. c.) relies upon this agent in *most acute forms of conjunctival and corneal affections*, including the various types of *phlyctenular infection*. He prefers:

R

Alphozon.	gr. i
Aq. dest.	fl. ̄iii

From 3 to 6 drops to be put into the eye three times a day.

Homer E. Smith (p. c.) uses it as a *collyrium in conjunctivitis of the catarrhal type*, in the proportion of 1:500.

# **Alsol.**

## *Burow's solution.*

This salt occurs in shining, colorless masses with a vinegar odor and an astringent taste. It is the proprietary name of a 50 per cent. solution of *aluminum acetotartrate*, and in ocular therapeutics is generally used in the form of compresses of 5 per cent. strength; one teaspoonful to a cup of boiled water. Alsol is said to have the advantage over boric acid and sublimate of not causing eczema of the lids when used as a local application. It is, therefore, especially valuable for compresses in blennorrhea neonatorum, in conjunctivitis, granular and scrofular ophthalmias, and, in warm solution, in chronic cases; also in hordeolosis, in corneal ulcers and iritis but in such case in solutions of 1:500 and 1:1000. It forms an acid solution with water but is insoluble in alcohol.

# **Apyonin.**

(See *Pyoktanin*, *yellox*.)

# **Alum.**

*Alumen. Aluminii et potassii sulphas.*  $KAl(SO_4)_2 \cdot 12H_2O$ .

This is the common potash alum, although there are several other double sulphates with an aluminum base, especially the ammonium "alum." All the alums are manufactured in enormous quantities for commercial purposes from native minerals. They occur as colorless, inodorous octohedrons and cubes, with a sweetish astringent taste. Fused, it loses all its water of crystallization and is converted into a whitish mass. (See *Alum*, *dried*.) The alums are very soluble in water but insoluble in alcohol.

Alum is generally used in trachoma, conjunctivitis follicularis, etc., in the pencil form alone or in combination with other astringents, although some surgeons continue to prescribe it in solution with distilled water. In my judgment it ought, in the latter form, to be laid aside for less irritating and more efficacious applications. (See *Copper sulphate* and *lapis divinus*.) When used in solution and instilled into the eye the dosage varies from one-fifth to two per cent. I have employed it as a substitute for copper sulphate in a one-fourth of one per cent. solution beaten up with white of egg (q. v.) and strained. This is a mixture that soon deteriorates unless kept in the ice-box.

In cases of *severe conjunctivitis where pain is an annoying symptom* J. C. Hancock (p. c.) prescribes the following:

**R**

Aluminis	gr. i
Cocain. mur.	gr. ss
Aquæ camphoræ.	fl. ʒi.

In *simple catarrhal conjunctivitis, both acute and chronic*, W. O. Moore (p. c.), uses the following prescription:

R

Acid. boric.	gr. vi
Alum. et potass. sulph.	gr. i
Aquæ dest.	fl. ʒii

These drops may be used at least three times daily.

J. C. Bloomfield (p. c.) applies the *alum pencil* directly to *phlyctenular ulcers of the corneal margin* and believes that this treatment shortens the length of the attack of this disease at least one-half.

The old-fashioned *alum poultice* is made by coagulating white of egg with alum, and enclosing the precipitated mass in a muslin bag. This application is said to be effective in reducing the swelling and discoloration of a recent "black eye."

## CHAPTER XXII.

### REMEDIAL AGENTS EMPLOYED IN THE LOCAL TREATMENT OF EYE DISEASES—CONTINUED.

*Alum Dried*—*Aluminated Copper*—*Aluminum Acetate*—*Aluminum Acetate-tartrate*—*Aluminum Carbonate*—*Alumnol*—*Alypin*—*Amidon*—*Ammonium Acetate*—*Ammonium Chloride*—*Ammonium Ichthyolate*—*Ammonium Bitartrate*—*Amyl Nitrite*—*Amylum*—*Anesin*—*Antinosin*—*Antipyonin*—*Antipyrine*—*Antiseptic-Crede*—*Apoatropine*—*Apyonin*—*Aqua Amygdalae Amarae*—*Aqua Aromatica*—*Aqua Calcis*—*Aqua Camphorae*—*Aqua Chlorata*—*Aqua Laurocerasi*—*Aqua Ophthalmica Nigra*—*Aqua Rosae*—*Aqua Sublimatis*—*Arecoline*—*Arecoline-eserine*—*Arganon*—*Arganon, New*—*Argenol*—*Argentamine*—*Argentol*—*Argentose*—*Argentum Colloidale*—*Argonin*—*Argyrol*.

#### **Alum, Dried.**

*Alumen exsiccatum*. Burnt alum.  $KAl(SO_4)_2$ .

When 100 grms. of ordinary alum are exposed to a heat slightly under 400° F. (295° C.) it loses its water of crystallization and a dry, white, porous mass results. This, when dried, forms a mild escharotic and powerful astringent and, as such, has been used on granular masses and fungating wounds of the lids, globe and orbit.

#### **Aluminated Copper.**

(See *Lapis divinus*.)

#### **Aluminum Acetate.**

$Al_2(C_2H_3O_2)_2$ .

This is a gum-like mass with an acid reaction and an astringent taste.

In eye diseases it is commonly used as Burow's Solution, a 7 to 8 per cent. solution of the acetate in water. This mixture is, in its turn, again diluted with five to twenty times its bulk of water before its employment as an astringent collyrium.

In cases of *chronic dacryocystitis*, with or without marked mucocele, the following constitutes an excellent form of *lachrymal lavage with the Anel* or similar syringe:

R

Alumini acetatis

3.00 (gr. xlv),

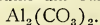
Aque dest.

100.00 (fl. ʒiiss).

There is also a *liquid alumini acetatis*, a clear, colorless liquid, having an acid smell and reaction with an astringent, sweetish taste.

**Aluminum Acetotartrate.**

This salt is found as colorless crystals, slowly soluble in water; insoluble in alcohol. It is occasionally used in *chronic conjunctivitis* in 0.20 to 0.50 solution, as well as as substitute for Burow's solution (q. v.). (See *Alsol*.)

**Aluminum Carbonate.**

Occurs in tasteless, chalk-white lumps, easily powdered. It is a mild styptic and astringent, and used as a *dusting powder* in *chronic forms of conjunctivitis*.

**Alumol.***Aluminumnaphtholsulphonate.*

This is a dry, colorless powder, easily soluble in water, less soluble in alcohol. It is an astringent and antiseptic and has been recommended as a collyrium, particularly in cases of *gonococcus conjunctivitis*, in 0.5 to 4 per cent. solutions. (See *Zinc Acetate* and *Zincol*.)

**Alypin.**

This agent is derived from glycerin, is closely related to *stovaine* (q. v.) and has been strongly recommended as a substitute for cocain as a local anesthetic.

Alypin is the proprietary name given to one of those numerous, complicated, organic compounds (mostly of German origin) that have in recent years flooded the market. In 4 per cent. solution it acts as a valuable and safe anesthetic for ophthalmic practice, as it has the same action as cocain without causing mydriasis, disturbance of accommodation, increase of tension, drying of the cornea or intoxication. It is a white, crystalline powder, soluble in water. We are indebted to Impens for its discovery.

Truc (9) has compared the effects of both alypin and cocain of the same strength and is unable to find any appreciable difference, the toxic effect being less from alypin than cocain. With alypin there is no mydriasis, even with strong solutions. Tonus and accommodation are not changed by alypin. It is important that the solutions should be fresh, neutral; old or acid ones being irritating.

When this anesthetic is used in conjunction with *silver nitrate*, *alypin nitrate* is to be preferred to the alkaloid. Owing to the fact that alypin is incompatible with silver nitrate it is not well adapted for anesthetizing mucous membranes to which nitrate of silver is afterward to be applied, as it may to some extent neutralize the effect of the latter through chemical decomposition. Alypin nitrate overcomes this difficulty, and is therefore recommended in such cases. Its chem-



ical characters, solubility, and strength of solutions correspond essentially to those of alypin.

Merck's *Reports* for 1906 quote the experience of Landolt that the *anesthetic action of alypin is somewhat greater than that of cocaine, but comes on more slowly*. As with the latter, the author has observed, after the instillation of drops of alypin, a transitory yet troublesome turbidity of the corneal surface with shedding of epithelium. An important point, however, is the fact that alypin is practically without influence on the pupil and on the accommodation. Kauffmann therefore *recommends the use of alypin whenever dilatation of the pupil is to be avoided*, and whenever the accommodation is to be preserved unimpaired; and again when the intraocular tension is raised, or when it would be dangerous to risk a rise of tension. It is also indicated, however, according to the author, when the tissue cells need special care, and when considerable changes or defects are present in the corneal epithelium, and when, further, there is no objection to hyperæmia at the corneal border, or in the conjunctiva. To produce anesthesia for the removal of foreign bodies, a 2-3 per cent. solution of alypin usually answers. The author gives the following as special indications for the use of alpin: Operations on the eye-ball, operations for uncomplicated lenticular cataract, operations for glaucoma, herpes, keratitis bullosa, defects due to injury, infective separation of the conjunctiva and abscess of the lachrymal sac.

Sidney Stephenson makes the following emphatic statement regarding it: That he had never seen a bad result from 2 per cent. alypin, despite the fact that from 1905 to August, 1908, it had displaced all other local anesthetics in his practice.

Sendral had good results with *alypin anesthesia in operations for senile cataract and secondary cataract*. In operations for chalazion where he both instilled alypin solution and also applied it subconjunctivally, he did not obtain complete immunity from pain, because the anesthesia was slow to extend into the tarsal tissues. In operations for squint, also, the anesthesia was incomplete.

#### Amidon.

(See *Starch*.)

#### Ammonium Acetate Solution of.

*Spirit of Mindererus.*

The solution contains (U. S.) not less than 7 per cent. of the salt. It is a colorless, faintly acid liquid, and is, occasionally employed as a *collyrium* with tincture of opium in *subacute and chronic forms of simple conjunctivitis*.

**Ammonium Chloride.***Sal ammoniac.*  $\text{NH}_4\text{Cl}$ .

This well-known salt, now mostly derived from the so-called coal-gas liquor, when pure, is a white, granular, crystalline powder, soluble in 2 parts of water and 50 of alcohol. It has a cooling but strongly saline taste.

Ammonium chloride is rarely used in ocular therapy, and then generally in conjunction with other remedies as a mild astringent, as in the following collyrium:

℞

Sulphur. sublimat.	3.0 (gr. xlvj)
Ammonii chloridi	1.0 (gr. xv)
Aquæ rosæ	50.0 (f̄3j, f̄3v)
Spiritus camphoræ	10.0 (f̄3iiss)

In filamentary keratitis (q. v.) a 2 per cent. solution of this salt is said to be beneficial as a collyrium, but I have had no experience of it.

Pick has used, in an eye cup, a 2 to 5 per cent. solution for *corneal opacities*.

**Ammonium Ichthyolate.**(See *Ichthyol.*)**Ammonium Bitartrate.***Acid tartrate of ammonium.*  $\text{NH}_4\text{HC}_4\text{H}_4\text{O}_6$ .

Occurs as white crystals, soluble in water; mostly used as a baking powder.

Guillery and zur Nedden\* advise the employment of 5 to 10 per cent. solutions of this salt, neutralized by the addition of liquor ammoniæ, in removing opacities of the cornea produced by lime burns. The solution is applied in an eye-cup three times daily. A little cocaine may be used in conjunction with the treatment, although the pain is not severe. To be effective the treatment must be applied early before the deposits take on the form of the carbonate.

For *recurrent attacks of styes* Lanvole finds the following mixture of decided value:

℞

Ammonii chloridi	1.00 (gr. xv),
Sulphur. precip.	3.00 (gr. xlv),
Spt. camphoræ	20.00 (fl. 5v),
Aquæ rosæ	50.00 (fl. 5iiss).

The lids are to be regularly bathed with this wash two or three times daily for several weeks.

---

\*Guillery and zur Nedden. *Archives of Ophthalmology*, Sept., 1907.

# Amyl Nitrite.

*Amyl nitris.*  $C_5H_{11}NO_2$ .

This agent is a yellowish, ethereal liquid with a peculiar fruity odor and aromatic taste. It is very volatile, very inflammable and distinctly poisonous. It is obtained by the action of nitrous acid on amyl alcohol.

Amyl nitrite has never, to my knowledge, been used locally in the treatment of eye diseases, but inhalation of the drug (in pearls or capsules on cotton, wool or in an inhaler) is a remedy for *scotoma scintillans*, *obstinate blepharospasm*, *cocain poisoning* and in the diagnosis and prognosis of certain optic nerve diseases—notably toxic amblyopia—when it is of great value. de Schweinitz believes it possesses curative properties in quinine amblyopia where it acts by expanding the contracted intraocular vessels. Of course it should be administered cautiously and early in the onset of the intoxication.

# Amyloform.

This condensation product of the action of *formaldehyde* (q. v.) on *starch* is a *white, odorless powder* eminently adapted as an antiseptic application to the ocular structure in *lieu of iodoform*.

# Amylum.

(See *Starch*.)

# Anesin.

*Aneson.*

The trade name given to a 2 per cent. aqueous solution of chlorotone (q. v.) or acetone-chloroform ( $CH_3$ )<sub>2</sub>:COH.CCl<sub>3</sub>, which has been recommended as a substitute for cocain. It is much less anesthetic than a 5 per cent. cocain hydrochloride solution, but is non-toxic and not irritating to the ocular structures.

# Anesthesin.

*Paraamidobenzoic-acid Ethylester.*

It is a white, odorless, tasteless powder, very slightly soluble in water, but easily dissolved by alcohol and olive oil. As a *local anesthetic* it is valuable and is employed in 10 per cent. strength as an ointment, and used as a *dusting powder*. In a limited way it is employed hypodermically in minor ophthalmic surgery. (See *Subcutin*.)

# Aniline Colors.

(See, also, *pyoktanin*, *toluidine blue*, *methyl violet*.)

Vogt\* gives the results of an elaborate series of researches upon the *action of the aniline colors upon the conjunctiva*.

His experiments, made upon rabbits, embraced over 70 different

\**Archives d'ophtal*, April, 1906



colors. He came to the following conclusions: If a small quantity of an acid, neutral or mordant color, or colors insoluble in water, be placed on the conjunctiva, little or no inflammation of the mucous membrane results, but if an equal quantity of a *basic color* is applied, intense inflammation, which may even lead to panophthalmitis, results. The various basic colors differ as to the intensity of the inflammation set up.

As regards relief, his experiments showed that the *action of even the most caustic basic colors may be neutralized by irrigating the conjunctival cul-de-sac with a 5 percent. tannin solution*. If solutions of sodium chloride, boric acid, or sodium bicarbonate (the very solutions most likely to be at hand) are used, they only intensify the caustic action, and do more harm than if nothing at all be used. These practical points are important, for with the modern development of the aniline industries, these accidents are becoming more frequent.

#### **Antinosin.**

*Nosophen-Sodium. Sodium tetraiodophenolphthalein.*

A blue powder recommended as an antiseptic to *replace iodoform*. It is soluble in water and used in from one-half to one per cent. solutions. It has been recommended as a gargle in *pharyngeal diphtheria*.

In cases of *simple catarrhal conjunctivitis* and hyperemia of the conjunctiva W. O. Moor (p. c.) uses a few drops of a *1 per cent. solution instilled into the eye three times a day*. Solutions of antinosin should be kept in a dark bottle and in a cool place.

#### **Antipyonin.**

This is a proprietary (48) mixture mostly composed of *sodic tetraborate*, used as a dry powder for dusting over corneal ulcers and wounds and into the sac for the relief of conjunctival affections. It is a substitute for iodoform, calomel, xeroform, etc., in lesions where these remedies are indicated. See, also, *Boro-Borax* and *Boricin*.

#### **Antipyrine.**

*Phenazone.—Analgesine. Parodyne. C<sub>11</sub>H<sub>12</sub>N<sub>2</sub>O.*

This is a mildly bitter, whitish, odorless powder, soluble in one part of water, alcohol or chloroform. Internally it is a poisonous antipyretic drug; locally it contracts the blood vessels with which it comes in contact.

It is *incompatible with* spirit of nitrous ether, iodine, and preparations containing iodine, mercuric chloride, tannic acid, phenol, thynol, phenyl salicylate, calomel, and the alkaline salicylates.

Although the use of this remedy in therapeutics is mostly internal it is on occasions employed topically. For example, Wicherkiewicz recommends it in from 5 to 10 per cent. aqueous solutions as a collyr-

ium in a number of conjunctival diseases, but I have little experience of it.

For the *relief of the smarting and occasional pain following the use of collyria* made with zinc sulphate, zinc chloride and other soluble zinc salts H. V. Würdmann (p. c.) advises the addition of  $\frac{1}{2}$  per cent. *antipyrine* to these mixtures.

W. K. Butler (p. c.) believes that *antipyrine* has an *anesthetic effect* in certain mixtures and uses it in *conjunctival catarrh* with irritative symptoms. He thinks that it may be substituted for the objectionable cocaine so commonly prescribed. Either of the following may be used, as indicated:

℞	
Antipyrin.	0.06
Acid. boric.	0.60
Aq. dest.	32.00

℞	
Zinci. sulph.	0.03
Antipyrin.	0.06
Acid. boric.	0.60
Aq. dest.	32.00

As a *cooling and detergent wash* in ordinary cases of *conjunctival catarrh or hyperemia* Nelson Black (p. c.) prescribes one of the following formulæ, directing that a few drops be put into the eye three or four times daily:

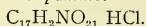
℞	
Cocain. hydrochlor.	0.030
Antipyrin.	0.10
Acidi, boric.	0.40
Aquæ dest.	15.00

℞	
Zinci sulph.	0.030
Antipyrin.	0.10
Aquæ camph.	
Aquæ dest.	āā 15.00

℞	
Antipyrin.	0.10
Acidi boric.	0.40
Aquæ camph.	
Aquæ dest.	āā 15.00

# Antiseptic-Crede.

A trade name for *Silver Citrate* (q. v.)

**Apoatropine.***Atropamine.*

Made from atropine by loss of water. Both this alkaloid and its salts—the sulphate and hydrochloride—are white crystals that are soluble in water and alcohol. They act like atropia but are not much used in ophthalmology.

**Apyonin.***Yellow pyoktanin. Benzophenoneid. (See Pyoktanin.)***Aqua Amygdalae Amarae.***Bitter-almond water.*

Made by dissolving one part of oil of bitter almonds in 1,000 parts of water. This mixture is by no means a constant medical agent, as its efficacy depends upon the proportion of *hydrocyanic acid* it contains, a variable quantity in bitter-almond oil. Bitter-almond water is used as an excipient in soothing collyria in much the same manner that *cherry-laurel water* is employed.

*Brenzcin* (q. v.), made by the action of anhydrous hydrocyanic acid on choral, has been used as a *substitute for bitter-almond water owing to its exact dosage*. One part dissolved in 160 parts of distilled water makes bitter almond water of the same strength as the P. G. The only question that arises is whether in *collyria* it is as free from irritating effects upon the eye as the best examples of this important vehicle.

**Aqua Aromatica.**

This mixture forms one of several excipients for collyria official in the German pharmacopeia. It is used as a mild astringent and eye-wash in simple conjunctivitis and conjunctival hyperemia.

℞

Misturæ oleoso-balsamicæ

Aquæ aromaticæ

aa 60.0 (5ii)

Aquæ foeniculi

100.0 (f5iij.f5iss).

**Aqua Calcis.***(See Lime Water.)***Aqua Camphoræ.***Camphor water.*

Approximately 8 parts of refined camphor can be dissolved by the aid of talc and other agents, in 1,000 parts of water. This solution forms one of the oldest eyewaters in the pharmacopeia and acts as a soothing and mildly stimulating astringent application, according to the amount of dilution and the other remedies prescribed with it.



J. A. Spalding (p. c.) complains that druggists follow no particular rule in preparing this important *vehicle for collyria*. He points out that formerly it was compounded by dissolving an ounce of camphor in an ounce of alcohol and then mixing the resultant powder with magnesia carbonate. The latest pharmacopeia substitutes talcum (*which is inferior to magnesia carbonate*) in place of the magnesia, and there is no explicit direction that the *alcohol should be allowed to completely evaporate before the resulting powder is dissolved in the water* and ample time (a month) allowed to get a perfect solution.

#### **Aqua Chlorata.**

*Aqua chlori.* (See *Chlorine water*.)

#### **Aqua Hamamelidis.**

Popularly known as *extract of witch hazel* or *distilled extract of witch hazel*. (See *Hamamelis*.)

This official preparation contains 15 per cent. of alcohol and although more popular with the laity than with the medical profession, makes a fairly useful constituent of evaporating lotions and stimulating collyria.

#### **Aqua Laurocerasi.**

*Cherry-laurel water.* (See *Cherry-laurel*.)

J. A. Spalding (p. c.) found on investigating the subject that no rule prevailed among the druggists in his neighborhood (and presumably in other localities) as regards *the mode of preparing cherry laurel water*. Some followed the U. S. dispensatory and used the essential oil; others followed the French Codex. The cherry-laurel water made according to the dispensatory *from essential oil of bitter almonds, cherry-laurel or peach-pits, is inferior in purity to the imported French water, and is very irritating to the eye*. He states that if we are to expect good results from the use of these valuable excipients, we must either direct our patients to a druggist who prepares them properly, or prepare our own lotions, or complain to the editors of the standard works in question, urging them to print proper directions in the making of these valuable waters for eye lotions. It would seem a matter of regret that medicines of so much comfort to irritated eyes should have to be laid aside owing to differences in preparation and without some proper substitute at hand.

#### **Aqua Ophthalmica Nigra.**

*Lotio nigra.—Black wash.*

This is the well-known but, in these modern times, little used, "black eyewater" of von Graefe; given by him as a wash in purulent ophthalmia. The formula is:

℞

Ext. hyoscyami	1.0 (gr. xv)
Aquæ rosæ	30.0 (f̄j)
Aquæ calcis	100.0 (f̄iif̄ii)
Calomelanos	0.6 (gr. ix)

The limewater precipitates the soluble mercurous oxide which, with the hyoscyamus, colors the mixture black. It resembles somewhat the *lotio nigra*, practically the "black wash" of the English pharmacopeia.

**Aqua Rosæ.**

*Rose Water.* (See *Rose*.)

**Aqua Sublimatis, P. G.**

*Liquor hydrargyri perchlor.* *Sublimatlösung.*

In the P. Br. the solution of corrosive sublimate is a colorless liquid, with a strong metallic taste, containing half a grain of bichloride to the imperial fluid ounce. In Germany it is frequently employed as an antiseptic with other agents, as in the following:

℞

Cocainæ hydrochloratis	0.1 gm (gr. iss)
Atropinæ sulphatis	0.05 gm (gr. 7-10)
Aquæ sublimatis (1-5000)	5.0 c. c. (f̄i¼).

℞

Scopolamini hydrobrom.	0.005-0.01 gm. (gr. 7-100-iss)
Aquæ destillatæ	
(Or aquæ sublimatis, 1-5,000).	5.0 (f̄i¼)

℞

Cocainæ hydrochloratis	0.1 gm. (gr. iss)
Aquæ destillatæ	5.0 c. c. (f̄i¼).
(Or aquæ sublimatis, 1-5,000).	

℞

Atropinæ sulphatis	0.1 gm. (gr. iss)
Aquæ sublimatis, (1-5,000).	10.0 c. c. (f̄iiss).

**Arachis, Oil of.**

(See *Oil of arachis*.)

**Arecoline.**

This is a poisonous, miotic alkaloid derived from the areca nut—*Arecha catechu* (betel-nut), a tall, East Indian palm. In its general action arecoline somewhat resembles pilocarpine. It was prepared as a hydrobromide ( $C_8H_{12}NO_2HBr$ ) by Merck in 1894. It occurs in the form of colorless, acicular prisms readily soluble in water and alcohol;

slightly in ether and chloroform. The areca nut also contains three other alkaloids—*pelletierine*, *arecaine* and *guvacine*—but only arecoline seems active. It is used as an eyewater in 1 per cent. solution.

#### **Arecoline-Eserine.**

This is a mixture (Merck) of *equal parts of arecoline hydrobromide* and *physostigmine (eserine) sulphate*. The combined action of these two miotics is greater than either of them exhibited separately.

#### **Arganon.**

A white powder said to contain 4 per cent of *silver casein*, soluble in hot water. It is used locally as an *antiseptic and astringent*. The ordinary strength of aqueous solution, to be used, especially in mucopurulent discharge from the eye, is 2 per cent. gradually increased to 10 per cent.

#### **Arganon, New.**

This is a light-yellowish powder slightly soluble but quite stable in water. It contains about the same percentage of silver as Arganon (q. v.) and is employed in strengths of from 1:500 to 1:200 in *purulent and mucopurulent conjunctivitis*.

#### **Argenol.**

An argentic albuminoid containing about 10 per cent. of metallic silver. It is found as brown crystals, easily soluble in water and glycerine. As a *substitute for the nitrate* it is by some observers preferred when silver compounds are ordered. The usual aqueous solution employed is from 1 to 10 per cent.

#### **Argentamine.**

##### *Liquor argentamini.*

This is a colorless 8 per cent solution of silver nitrate or phosphate in a 15 per cent. solution of ethylenediamine, and corresponds to a 10 per cent. solution of the silver salt. It is astringent and antiseptic, like other silver salts, but is said to be less irritating and more penetrating than the nitrate and is used wherever it is indicated.

Daxenberger (37) was one of the earliest ophthalmologists to advise its use. He commends it in all cases of conjunctivitis, brushing a 5 to 10 per cent. solution over the everted lids. In addition to this a 3 per cent. solution is to be instilled. The writer prefers it in ophthalmia neonatorum; also in 3 per cent. solution as a prophylactic. He considers its value to be due to the fact that its bactericidal action is upon the sub-conjunctival tissues; that it is not superficial in action like most other silver salts.

#### **Argentol.**

##### *Silver quinaseptalate. Silver oxyquinoline-sulphonate.*

This agent is a yellow powder, sparingly soluble in water and alco-

hol, and readily affected by light. It is recommended, in 1:1000 to 300 solutions, in purulent diseases and catarrh of the conjunctiva.

#### **Argentose.**

This is a *soluble compound of silver and a nucleoproteid*, containing 30 per cent. of the former. It is an effective germicide and is used *like silver nitrate in acute conjunctivitis* and as a prophylactic in ophthalmia neonatorum.

#### **Argentum Colloidale.**

*Collargol. Argentum Credé. Argentum Solubile.*

An allotropic form of silver, said to consist of 86 parts of metallic silver, some silver oxide, and albumen. It is made by the action of sodium citrate and ferrous sulphate on nitrate of silver. Collargol occurs as black, scale-like pieces, soluble in twenty parts of water. It has been used in blenorrhœa neonatorum and other infective processes, but its chief use is in the preparation of Credé's ointment which is composed of collargol 15 parts, water 5 parts, white wax 10 parts and benzoated lard 70 parts. In ophthalmic surgery it is a valuable antiseptic counterirritant, to be applied as a poultice to the lids in most serious cases of intraocular inflammation. The ointment is smeared on the closed lids and eyebrows at night, a bandage is applied and the greasy mixture washed off with warm water in the morning.

#### **Argonin.**

*Silver sodio-caseinate.*

Prepared by adding silver nitrate to the sodium compound of casein. It is a fine white powder, containing about four per cent. of silver and is but slightly soluble in water.

Like argentamine (q. v.) it penetrates more deeply than silver nitrate and does not coagulate the albumen. In ophthalmia neonatorum and allied diseases it is used in 3 per cent. solutions; smaller doses in milder infections of the conjunctiva where silver nitrate is indicated.

According to Snellen\* Argonin L. (*lösliches Argonin*), a newer preparation is freely soluble in water, is found as a light-yellow powder and contains 10 per cent. of metallic silver. According to Sellink it is markedly bactericidal.

E. C. Ellett, Trester Smith, Horace Bigelow and others have reported the satisfactory employment of this agent, in 5 and 10 per cent. solutions, instead of silver nitrate in the treatment of *purulent ophthalmia*—especially in gonococcal infections. The last-named observer believes that its easy solubility, deep penetration of the tissues, germ-

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\*Snellen. *Graefe-Saemisch Handbuch*. 2nd Edition. 100. p. 17.

icidal qualities and the fact that strong solutions do not require neutralization make it an ideal remedy in the treatment of both infantile and adult gonorrheal ophthalmia.

### **Argyrol.**

#### *Silver vitelline.*

This is a proteid salt of silver containing from 20 to 25 per cent. of the metal. The watery solution is yellowish or black according to its strength. It stains the skin and, like other silver salts, may produce a permanent or at least lingering argyrosis.

It is non-toxic and is said to be distinctly antiseptic.

F. Krauss\* relates the case of a child, aet. 4, who had a *chronic dacryocystitis* for which 20 per cent. argyrol was dropped into the eye for 20 minutes. At the end of that time the ocular and palpebral conjunctivæ were *tinged a bluish-green color*.

That *argyrol is capable of permanently staining other parts of the ocular apparatus besides the lid skin and the conjunctiva* has been demonstrated in a number of instances. Quite recently I saw an adult case of gonorrheal ophthalmia with a central corneal ulcer, in whom, under the treatment of a competent and careful ophthalmologist, argyrol in the usual doses had been employed for several months. Nearly a year after the attack the healed ulcer showed an irregular, pigmented ring (from 1 to 2 mm. wide) encircling the pupillary area—evidently due to the argyrol.

These experiences emphasize the need of using always perfectly fresh solutions kept from the light and air in, if possible, a cool or quite cold place. It should also be remembered that applications to abraded surfaces of even unaltered solutions are not without danger of argyrosis.

This organic compound was first described by Barnes and Hille (2) as occurring in dark-brown or black-glistening flakes readily soluble in water and glycerin. Twenty per cent. solution is entirely non-irritating to the normal conjunctival sac. In from 5 to 25 per cent. watery solution it has been widely recommended as a substitute for silver nitrate. I have not, so far, been able to satisfy myself that equal results are so obtainable but still think that on those comparatively rare occasions where inorganic silver salts are indicated, the most effective remedy is still the nitrate. On the other hand, both argyrol and its companion salt, protargol, have a therapeutic value all their own and, when properly employed, are superior to other organic salts in any dose.

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\**Ophthalmic Record*, March, 1908.

In any event argyrol solutions should be freshly prepared as they are prone to deteriorate on standing. Bruns believes that the best results in severe cases of blenorrhœa are to be obtained by erecting a dam of wax or paraffin about the margin of the orbit and immersing the eye in a strong solution for periods of an hour or two, day and night. As the agent is non-irritating its full effects can thus be secured without pain or damage to the eye. McGillivray\* gives a fair account of the therapy of argyrol which I quote almost in its entirety.

"Judged from the bacteriological standpoint, Argyrol would seem to rank inferior to nitrate of silver as a germicide, and to be of little real value as a substitute for this time-honored preparation. Be that as it may, those who have given Argyrol an extensive clinical trial, and who are thereby able to judge of its therapeutic value, are enthusiastic in its praise.

"It is very soluble in water, but incompatible with cocaine hydrochloride and other alkaloids. We have used it chiefly in 10 and 25 per cent. aqueous solution, and have found that its instillation into the eye is not only painless, but it is followed by a feeling of comfort and relief. When the solution is kept for some time, and especially in the light, it decomposes, and is then liable to cause irritation. It should therefore always be freshly prepared, and kept in the dark or in non-actinic bottles.

"The chief objection to the use of this drug from the patient's standpoint is that it stains the skin and handkerchiefs a deep chocolate-brown color. This objection, however, is trifling, for the skin stains can be readily washed away with water, while linen stains are instantly removed by dipping the fabric in 1 in 1000 bichloride of mercury solution. We have not had a single case of argyrosis—permanent staining of the conjunctiva—with Argyrol. One complaint one frequently hears is that the drops pass down the tear duct into the nose and pharynx, and may alarm the patient, unless previously cautioned, owing to their brown color and metallic taste. This objection is really a merit, as it will be seen when we come to discuss the treatment of lachrymal affections.

"The great advantage Argyrol possesses over nitrate of silver lies in the fact that its application is painless, even in strong solution, and that it can be used freely and frequently by the patient without any risk. Nitrate of silver is, as you are aware, a dangerous remedy, except in the hands of the surgeon, and its application, even in 2 per cent.

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\**Scottish Med. and Surg. Journal*, May, 1907.



solution, is attended with such excruciating pain as to make the strongest shudder.

*"Ophthalmia Neonatorum.*—After the discharge has been removed by the free use of the douche and saline solution, some half-dozen drops of a 25 per cent. Argyrol solution are instilled into the eye, the chin meanwhile being held higher than the forehead. This is again repeated every half hour during the day, and the margin of the lids are kept smeared with vaseline during the night. If the discharge be copious, the saline douching is repeated every half hour or so. This method of treatment has given us admirable results, for all our cases have done well, and corneal ulceration has not been seen since we systematically adopted it three years ago. If the treatment just described be properly carried out, the discharge will be found to become speedily diminished, and recovery will be more rapid than if the lids be everted, their conjunctival surface brushed daily with a 2 per cent. solution of nitrate of silver, and mild antiseptic douchings employed at frequent intervals. In applying the Argyrol solution it is not necessary to evert the lids, as in the case of nitrate of silver. This proceeding in the hands of the unskilled is a source of grave danger to the cornea. With Argyrol all that has to be done is to remove the discharge thoroughly with the saline douche, then instil some half dozen drops of the solution into the eye.

*"Simple Catarrhal Conjunctivitis.*—During the acute stage and in milder types there is no remedy that we have tried to compare with frequent instillations of a 10 per cent. Argyrol solution. In the severer types, 25 per cent. solution should be employed, especially in those cases that are on the borderland of purulent conjunctivitis. The discomfort experienced in these cases is relieved instantly after the instillation, the discharge becomes rapidly checked and recovery is obtained, as a rule, without the least discomfort to the patient. The treatment should be applied every two or three hours, or oftener, if the discharge is plentiful. If the affection does not go on to complete recovery, as sometimes happens, but passes into the subacute or chronic stage, where there is little or no discharge, Argyrol is useless, and its place should at once be taken with any of the older collyria. It is during the catarrhal or purulent stage of conjunctival affections that Argyrol is not precipitated by the sodium chloride of the tears, so that simple instillation is all that is necessary, provided the patient holds the chin higher than the forehead, to enable the fluid to find its way into the upper *cul-de-sac* by gravitation. The head should be held in this position for a full minute or so after the in-

stillation, during which time the patient should wink freely, to allow the solution to become diffused over the whole conjunctival surface. When the patient sits up it is a good plan to get him to blow the nose freely, so as to flush out the tear ducts.

*"Chronic Conjunctivitis.*—When this form of conjunctivitis is attended with discharge, Argyrol solution is useful only in checking the discharge and preparing the eye, so to speak, for more suitable treatment. If there be little or no accompanying discharge, Argyrol is practically useless. When the condition is associated with hypertrophy of the palpebral conjunctiva and eversion of the eyelids, 2 per cent. nitrate of silver solution, applied daily by the surgeon with a camel's hair brush to the everted eyelid, is by far the best non-operative treatment.

*"Corneal Ulceration.*—In simple corneal ulcers Argyrol and atropine drops are very useful, in 10 and  $\frac{1}{2}$  per cent. solutions respectively, instilled three times a day, the atropine drops being applied half an hour or so after the Argyrol. In catarrhal ulcers this treatment is also very satisfactory, but in sloughing ulcers of the cornea, with hypopyon, it is disappointing, even although freely and frequently applied in 25 per cent. solution. When the condition is due to pneumococcal infection it is also a failure, and no time should be lost in applying the cautery. In phlyctenular keratitis, with or without vascularisation, Argyrol solution is of no use; yellow oxide of mercury ointment, with cocaine and atropine, is certainly the best treatment we know of.

"We have found Argyrol of very little use also in follicular, granular, and diplo-bacillary conjunctivitis, except as an adjuvant in checking the discharge.

*"Tear Duct Affections.*—In simple epiphora, due to inflammatory swelling of the lachrymal passages, Argyrol is most beneficial. We treat these cases with instillations of a 10 per cent solution, teaching the patient to press over the lachrymal sac with the finger while the head is held well back and turned slightly to the opposite side, the idea being to get the fluid into the sac and down the nose on the principle of the filling and emptying of a ball syringe. Should this fail after a fortnight or three weeks' trial, we pass a No. 2 Bowman's probe down the duct into the nose without dividing the canaliculus. The probe must be passed with the greatest care, so as to avoid injuring the lining membrane of the duct. The instillations of Argyrol, etc., are continued three times a day for a few weeks. Improvements will be found on the second or third day if the treatment is to be successful. We have tried this method of treatment in this troublesome

affection for nearly three years with very gratifying results. In chronic dacryocystitis, or mucocele, after dividing the lower canaliculus and passing the largest Bowman's probe, the patient is instructed to empty the sac by pressing over it with the finger, and to instil a 25 per cent. solution of Argyrol solution over the inner canthus, the same manipulations for getting the solution down into the nose, as described in the management of simple epiphora, being adopted. Under this treatment the discharge from the sac soon becomes arrested, and fewer probings are necessary. The same treatment is adopted in dealing with tear duct obstruction where a style is employed. The use of an Anel's syringe, with Argyrol solution, in the treatment of lachrymal affections may be attended with unpleasant consequences. It sometimes happens, especially with a restless patient that the mucous membrane of the duct becomes abraded, when the fluid may pass into the subcutaneous tissue, and leave a slight permanent staining of the eyelids.

*"Preparation for Operative Interference on the Eye.*—In preparing the eye for operative interference, such as for cataract extraction, when there is evidence of discharge, as shown by staining of the dressing, or by obscuration of the ophthalmometer mirror by mucus, we have used Argyrol solution in the strength of 25 per cent. solution, to diminish the activity of the conjunctival flora. The results obtained are thoroughly satisfactory, for we have not seen a case of suppuration following operations since this method of treatment has been adopted some three years ago.

*"Blepharitis.*—The treatment of simple or squamous blepharitis by Argyrol is, in our experience, inferior to that with yellow oxide of mercury ointment. In ulcerative blepharitis the best results we have had have been with nitrate of silver in 2 per cent. solution, applied to the margin of the eyelid after the crusts have been carefully removed with a weak, tepid solution of baking soda. The nitrate should be applied daily till the ulcerative condition has healed up, when the treatment with simple yellow oxide of mercury ointment, applied three times a day, should be adopted. The ointment should be continued for a few weeks after the lids appear well, to prevent a relapse, and any refractive error should at the outset be corrected and suitable glasses be worn constantly.

*"During the past few months we had three most typical cases of dendritic corneal ulcers under treatment about the same time in the hospital. Each case, to begin with, was treated with 25 per cent. solution of Argyrol every hour or two, but without the least beneficial re-*

sult. On applying the galvano-cautery, however, recovery soon took place."

A. Duane (p. c.) uses argyrol *in all forms of acute conjunctivitis*. He employs it especially *when there is much secretion both for office and home treatment*. The patient is instructed to apply it as follows: First wash out the eye freely with an indifferent solution (saline or boric acid); then drop in the argyrol; then after 5 minutes wash out this with the coagula that it has produced; then instill argyrol again and this time let it remain. This prevents the disagreeable sensation of a foreign body that is produced if the argyrol and coagula are left in. He also uses argyrol (preceded by adrenalin) in lachrymal disease; but now only by instillation—never by injection into the sac.

Many physicians prefer to use this remedy *as an ointment rather than in solution* and it may be employed in this way in all strengths. Lanoline, petrolatum and cold cream form good excipients.

So far as argyrosis is concerned I have seen several cases of it—the stains generally resulting from an attempt to force a solution into the tear sac or through the nasal duct into the nose. I believe the greatest care should be observed in the employment of argyrol in all forms of dacryocystitis.

## CHAPTER XXIII.

### REMEDIAL AGENTS EMPLOYED IN THE LOCAL TREATMENT OF EYE DISEASES—CONTINUED.

*Aristol*—*Arlt's Salve*—*Artificial Blood Serum*—*Aseptol*—*Atrabilin*—*Atropine*—*Atropine Methylbromide*—*Atropine Santoninate*—*Atroscine*—*Auri et Sodii Chloridum*—*Beech Oil*—*Belladonna*—*Belladonine*—*Belmontin*—*Benzoated Lard*—*Berberine Sulphate*—*Birch Oil*—*Betanaphthol*—*Blenol*—*Blue Ointment*—*Boracic Acid*—*Borax*—*Boricin*—*Boro-borax*—*Borol*—*Bismuth Subgallate*—*Boroglycerin*—*Brenzcin*—*Brown Ointment*—*Cacao*—*Cade Oil*—*Cadmium Salicylate*—*Cadmium Sulphate*—*Calcium Hypochlorite*—*Calcium Permanganate*—*Cali*—*Calomel*—*Calomelol*—*Camphor*—*Cantharides*—*Caprenalin*—*Carbolic Acid*—*Carron Oil*—*Castor Oil*—*Catalpa*—*Cerevisine*—*Chamomile*—*Cherry Laurel*—*Chloral Hydrocyanate*—*Chinosol*—*Chloral Hydrate*—*Chloretone*.

#### **Aristol.**

*Thymotol*. *Thymol iodide*. *Thymodin*. *Iodistol*. *Iosol*. *Iodosol*. *Annidalin*. *Dithymol diiodide*.  $C_{20}H_{24}O_2I_2$ .

Iodide of thymol (U. S. P.) is a yellow-red powder with faint aromatic odor, insoluble in water, slightly soluble in ether, very soluble in chloroform, containing 45 per cent. of iodine. It is made by the action of iodine, potassium iodide and sodium hydroxide on thymol.

This remedy was much exploited as a substitute for iodoform but, in my hands at least, has failed of expectation. It is, however, a mild, and, in every regard, inoffensive preparation worthy of trial where a simple, antiseptic, iodine, dry dressing is needed. Vignes thinks it does not irritate the eye or increase secretion. It has been recommended as an application in interstitial keratitis.

Daxenburger (29) also recommends the use in lime burns, blepharitis and phlyctenular keratitis, in a ten per cent. mixture in oil of sesame. This is a transparent, red-brown fluid which does not throw down a deposit or become rancid.

#### **Arlt's Salve.**

This ointment is less known and used in America than in Germany. It is prescribed as an analgesic and counterirritant to relieve the bulbar congestion and pain of scleritis, iritis, corneal ulcer, etc., and for the blepharospasm of phlyctenular keratitis. It may be rubbed

into the temples and forehead three or four times daily. Ohlemann, in Oliver's translation, gives the formula as:

R

Ungt. hydrarg. cinerei (P. G.)	5.0 gm.
Extract belladonnæ	0.5 gm.

For the first ingredient one may substitute *unguentum hydrargyri ammoniati*, U. S. P., which it resembles.

#### Arterenol.

*Dioxyphenylethanolamin hydrochloride. Aminoalcohol.*

This product is said to be as efficient a vasoconstrictor as suprarenin and from two to three times less toxic. This has been established by experiments on animals; the fatal dose of suprarenin being 4 mgm. subcutaneously and 0.1 to 0.3 mgm. intravenously per kilogram of body weight in rabbits, while twice this amount of arterenol was necessary to produce death. While equally efficient as suprarenin synthetic (q. v.) it is qualitatively equal to suprarenin as regards increase of blood pressure and effect upon respiration and pupil.

#### Artificial Blood Serum.

*Plasma.*

Murray McFarlane (p. c.) uses a tablet (Parke, Davis & Co.) which contains *osmotically active salts of the blood* which, added to 1000 drops of water, makes a solution of the same alkalinity, specific gravity and cryoscopic index as the *liquor sanguinis*. In diseases of the eye, characterized by increased secretion he uses this plasma solution for *irrigation of and cleansing the cul-de-sac*. It may also be employed instead of distilled water in collyria containing such remedies as are not incompatible with sodium and potassic salts. He has also used it with good results, with or without dionin, mercuric cyanide and other drugs, in *subconjunctival injections*.

#### Aseptol.

*Sozolic acid. Orthophenolsulphonic acid. Orthosulphocarboic acid.*  $C_6H_6O_4S$ .

The solution marketed by Merck under the trade name of Aseptol contains *one part in three of sozolic acid* and is a clear, yellowish liquid with an odor of carboic acid. It is very soluble in water; less soluble in ether and alcohol; a disinfectant *much less toxic yet more efficient than phenol*. It should not be exposed to light. In from one to ten per cent. watery solutions it may be used as a *germicide* in most external diseases of the eye.

#### Atrabilin.

The name given to the first of the suprarenal extracts to



be placed on the market and to Dor and Bates\* we are indebted for its introduction into ophthalmic surgery.

This remedial agent is practically identical with adrenalin. It was also warmly recommended by Zimmerman and Wolffberg (31) who advise that it be used with formalin 1:5000, as a preservative.

Darier and Dor both pointed out the advantage of combining cocain with atabalin in operations on and affections of the eye.

### Atropine.

*Atropia.*  $C_{17}H_{25}N_3$ .

Colorless or whitish, acicular crystals with a bitter-acrid taste, soluble in 450 parts of water, 1.50 parts of alcohol, 17 parts of ether, at 77° F. It is also soluble in glycerin, benzine and olive oil. Its best known salt is the sulphate, but it must be remembered that the alkaloid, the borate, iodate, oleate (for ointments), salicylate, santoninate, valerianate and other salts have been used in ocular therapy.

The alkaloid is obtained from *Atropa belladonna* and other plants of the same family and is isomeric with daturin. It is the salt of an organic base called tropin (tropin tropate) but in ophthalmic practice is generally employed as the sulphate which it closely resembles.

Atropine and most of the other cycloplegics are *chemically incompatible* with the alkalies, tannin, the salts of mercury; *physiologically incompatible* with opium and its derivatives, pilocarpine, muscarine, aconitine and eserine.

Atropia is a powerful cycloplegic and mydriatic and may act as a poison even when instilled into the conjunctival sac. In toxic doses it causes dryness of the throat, vertigo, frequent pulse, a scarlatinous rash, hallucinations and delirium. A single drop of a one per cent. solution of atropia sulphate produces mydriasis in about 15 minutes and cycloplegia in two hours. It stimulates the radiating muscular and sympathetic fibers of the iris while it paralyzes the peripheral cells of the motor oculi supplied both to the iris and to the ciliary muscle. Instilled thrice daily for two days the cycloplegia last from seven to twelve days—the dilation of the pupil somewhat longer. Atropia also increases the intraocular tension and this fact should always be borne in mind in cases of suspected glaucoma.

Most of its effects have been noted during the internal administration of belladonna or its derivatives, during its use as a liniment, as an ointment and as a plaster. The tears that flow from an eye under treatment by an atropine collyrium may act as a mydriatic if accidentally introduced into the fellow eye or the eye of an attendant.

\*Bates *New York Medical Journal*, May, 1896.

Owing to the extreme susceptibility of many patients to the poisonous effects of eye-drops I rarely use the drug in stronger solutions than one per cent., ordering one drop only to be instilled at a sitting and then, when possible, after meals, when absorption takes place most slowly. The eyelashes are then wiped perfectly dry with cotton from the inner canthus outward. Many surgeons advise pressing the finger over the region of the lachrymal sac at the time of the instillation, but I believe the precautions just mentioned are much more effective and apply with equal force to the use of all poisonous collyria. A single drop of a 1:45,000 solution of the atropin will dilate the normal pupil in less than an hour.

Michel thinks the toxic danger point is reached when, at one sitting, eight drops of a one-half per cent. solution is instilled into the conjunctival sac, but the conditions under which it is used and the idiosyncrasy of the patient chiefly determine the toxic effect. This important matter is discussed under the heading Cycloplegics.

Hirschberg in severe cases of acute iritis instills the drug every hour or two the first day; afterwards every two hours daily, and night if need be. As Noyes has said, "atropia is the beginning, the middle and the end of the treatment of all forms of iritis," and there is much to justify such a sweeping statement. Judiciously exhibited in conjunction with general treatment, hot applications, dionin and cocaine its fullest effects are apparent in relieving the symptoms and preventing the serious sequelæ of this disease. It gives rest to the musculature of the inflamed organ, relieves its morbid vascularity, prevents the formation of (or breaks up) posterior synechiæ and acts as a sedative to the irritated nerve-endings.

In scleritis, choroiditis, retinitis and the majority of cases of corneal ulcer atropia is also indicated. It is contra-indicated in glaucoma and in total (ring) synechia.

Atropin irritation and conjunctivitis form an idiosyncrasy which may be suspected from the roughness of the palpebral skin, the dry throat and other toxic symptoms following an ordinary dose of the drug. When atropia is thus badly borne, scopolamin or duboisin (in one-tenth or one-twentieth the dose of atropine) may be tried, or the drug in reduced dosage used as an oily solution or in the form of ointment.

For the double purpose of *increasing its cycloplegic effect* and of *inhibiting its poisonous tendencies* D. M. Griffin (p. c.) makes use of the following formula when employing *atropine in refraction work*:

R

Atropiæ sulph.	gr. iss
Dionin.	gr. ss
Aquæ dest.	fl. ʒii

When solutions of atropine fail to produce the desired effect H. H. Martin (p. c.), uses *finely powdered atropine sulphate*, as much as can be picked up on the point of a pen knife, placed in the lower conjunctival sac. The eye is cocainized previous to this application and the patient or nurse directed to exert pressure with the finger over the lachrymal sac for five minutes.

#### Atropine Methylbromide.

(See *methylatropine bromide*.)

#### Atropine Santoninate.

(Not the "santonate.")

A white powder quite soluble in water.

This salt is particularly mentioned to draw attention to the fact that while quite equal in solubility and medicinal action to the methylbromide, nitrate, salicylate, sulphate, borate and other favorite compounds or atropia used in ophthalmic practice, it does not so readily as they undergo decomposition and if kept in dark bottles *retains its cycloplegic and other qualities almost indefinitely*.

#### Atroscine.

*Iota scopolamine.*

This cycloplegic alkaloid, found as transparent, colorless crystals, sparingly soluble in water, is derived from commercial hyoscyne or scopolamine.

Macklin (25) prefers it to other cycloplegics for determining refractive errors, and uses it as a one per cent. solution in castor oil. He says it acts as a rapid and powerful mydriatic and cycloplegic, is as potent and reliable as atropine sulphate, while the power of accommodation returns in five days. Of course, with homatropine the ciliary paresis ceases in 24 hours, which is undoubtedly a great advantage in many cases, yet homatropine has disadvantages which must be apparent to all who use it. Mydriasis with atroscine begins in ten minutes and is complete in twenty. Cycloplegia begins in ten minutes and is complete in about fifty.

The hydrobromide is very soluble in water and for that reason is to be preferred to the pure alkaloid.

There is an *inactive form of atroscine* (Merck) with the formula  $C_{17}H_{21}NO_4 + H_2O$ , colorless, transparent crystals, very slightly soluble in water, that in *one per cent. solution* (preferably castor oil) *acts as a miotic*.

**Auri et Sodii Chloridum.***Gold and sodium chloride.*

In Germany this remedy (probably only a mixture of the two chlorides) is occasionally used as an eyewash.

R

Sodii boratis	0.5 (gr. vii 7-10)
Aquæ destillatæ	20.0 (f 5 v, mviii)
Auri et sodii chlor.	0.03 (gr. 23-50).

To be instilled twice daily in cases of simple conjunctivitis.

**Beech, Oil of.***Oleum fagi.*

A tar product, essentially the *pix liquida* of our pharmacopeia, official in the Austrian codex. It is a thick, viscid mass of a dark brown color, some of its many constituents slightly soluble in water; more soluble in oil and ether.

This remedy has been recommended undiluted as an application in blepharitis complicated by thickening or chronic infection of the conjunctiva. It is used as a more cleanly substitute for iodine and tar ointment, and as such should not be allowed to reach the conjunctiva but is to be painted on the dermal surface. The application had better be made at night and may be repeated at intervals, to irritate the skin without destroying its epithelium.

**Belladonna.***Atropa belladonna.*

Although the many alkaloids derived from *Atropa belladonna* are extensively employed in ophthalmology the extract is the only preparation of the plant proper (leaves or root) now used in the treatment of eye diseases. It is generally employed alone or in conjunction with other remedies, as in Arlt's ointment (q. v.) as a salve to be rubbed into the temples and frontal region for the relief of pain due to eye-strain or inflammatory affections of the globe.

**Belladonnine.**

This is a *mydriatic extract* from the mother-liquor in the preparation of atropia crystals. It is an amorphous, brown, varnish-like mass slightly soluble in water. It is not used to any extent in ophthalmic therapy.

**Belmontin.**

This preparation is practically identical with paraffin, the well known white, greasy, tasteless, odorless, waxy product of the dry distillation of petroleum and other oils. It is of interest to us only as a base for the preparation of eye ointments.

# Benzoated Lard.

*Adeps benzoatus. Ointment of benzoïn. Axungia balsamica.*

Hog's lard impregnated with benzoic acid and the odorous principle of gum benzoïn.

That the benzoïn in this preparation has any curative effect when applied alone or in conjunction with other remedies I am not prepared to say but, in common with several ophthalmologists, I have found it a trusty application in the simple forms of *blepharitis* and as an ointment to prevent adherence of the lids in conjunctival discharge.

# Berberine Sulphate.

The salt of an alkaloid obtained from *Berberis vulgaris* (Barberry, Jaundice Berry, Sowberry), (*Hydrastis canadensis*) and many other plants. It is found in the market (Merck & Co.) as yellow, acicular crystals and, when pure, is soluble in water and alcohol. This alkaloid and its salts have been confused with *hydrastine* (q. v.), *yellow hydrastine sulphate* and *yellow hydrastine muriate*. In some parts of this country these names still indicate the corresponding berberine salts.

S. R. Weaver, (p. c.) employs this remedy in most forms of *conjunctivitis associated with discharge*, from gonorrheal ophthalmia to simple conjunctivitis.

R<sub>x</sub>

Berberin. sulph.	gr. iiss
Acidi borici	gr. x
Sodii. bibor.	gr. v
Morph. sulph.	gr. ss
Aquæ dest.	fl. ʒi.

Put four or five drops into the eyes every two hours.

# Birch Oil.

*Betula, oil of*

A reddish-colored, volatile oil obtained from several members of *Betula* by decomposition of their most important constituent, the glucoside *gaultherin*. It closely resembles oil of wintergreen, and like it, is almost a pure methyl salicylate.

As a substitute for tar ointments the oil of birch has been prescribed. It is applied with a brush or glass spatula to the skin surface of the lid as a counter-irritant in chronic belptharo-conjunctivitis. It is extremely irritant to the eye and should not be allowed to touch the globe or enter the sac.

# Betanaphthol.

*Naphthol. B-Naphthol. Beta-monohydroxy-naphthalene. C<sub>10</sub>H<sub>7</sub>OH.*

This is a phenol occurring in coal-tar and found in the market as a colorless or pale-yellow, crystalline, scaly, powder with a faint phenol

odor and a sharp taste. It dissolves slightly in water; soluble in alcohol and oils.

This agent is generally used as an *antiseptic* and *parasiticide*, especially in the form of ointment. It is incompatible with antipyrine, camphor, phenol, potassium permanganate and menthol.

Panas advised the employment of naphthol as a lotion in the second stage of simple acute conjunctivitis:—

R

Betanaphthol.

1.00 (gr. xv)

Alcohol. q. s.

Aquæ dest.

1000.00 (Oij)

To be freely applied with a pipette.

### **Blenol.**

The trade name of a mixture intended for the treatment of simple, acute and *chronic conjunctivitis*, *trachoma*, etc., and said to be useful in both instances when diluted in the proportion of one part to 12 parts of water. Blenol is said to be a solution of the *double citrate of bismuth and hydrastine*, each fluid dram containing  $2\frac{1}{2}$  grains of the double salt, 25 per cent. of which is hydrastine citrate.

### **Blue Ointment.**

(See *Unguentum hydrargyri dilutum*.)

### **Boracic Acid.**

*Boric Acid.* (See *Acid, Boracic.*)

### **Borax.**

(See *Sodium borate.*)

### **Boricin.**

This is a mixture of equal parts of borax and boric acid (q. v.) and may be used where either or both of these agents are indicated. In ordering it for collyria it is well to remember that borax is soluble in 20 parts and boracic acid in 25 parts of cold water. See Boro-borax.

### **Boro-borax.**

This is a name given to a mixture recommended by Joenicke as an application in *simple ulcer of the cornea*. It is made by dissolving *equal parts of borax and boric acid* in hot water and allowing them to crystallize. A ten per cent. solution forms a most useful antiseptic, irritating fluid. It closely resembles *boricin*. (q. v.) and *anti-pyoin* (q. v.), the latter the so-called disodic dodecaborate recommended by Rolland. These sodium salts are also used as a *fine dusting powder* directly to *corneal ulcer*.



# Borol.

This is a trade (Parke, Davis & Co.) name given to the following antiseptic mixture:

R

Sodii boratis	gr. xii,
Sodii bicarb.	gr. v,
Sodii benzoat.	fl. ʒiss,
Eucalyptol.	m ¼,
Thymol.	gr. 5-16,
Menthol.	gr. 1-8,
Ol. pini pumilio.	q. s.

This mixture, when diluted with 10 to 20 times its volume of water, acts well as a mild irrigating fluid and cooling collyrium in most forms of *conjunctivitis*. The only objection to it is its "blunderbus" character; probably it would act just as well if the "oil of pine, q. s.," were omitted. Otherwise I can recommend it as a useful lotion for *hyperemia of the conjunctiva*, in a five per cent watery dilution.

# Bismuth Subgallate.

*Dermatol.*

It occurs as a fine, yellowish, odorless powder, insoluble in water or ether, and unaffected by light or 100° C. It is consequently admirably adapted to dressings when a sterile, neutral powder is needed—as in any of the eruptions on the lid skin attended by secretion. It is best known by its trade name of *dermatol*.

# Boroglycerin.

*Glycerite or glyceride of boric acid. Boroglyceride. Glyceryl borate.*  $C_3H_5BO_3$ .

A compound of glycerine and boracic acid by heat. It is a hygroscopic, white, glassy, transparent, brittle mass, soluble in cold water but decomposed by hot water.

This antiseptic is sometimes used in ocular therapy in purulent conjunctivitis in 20 to 50 per cent. solutions. C. C. Stephenson (p. c.) employs it as a menstruum for tannic acid in the treatment of *trachoma* (q. v.).

Webster Fox (*Text-book*, page 551) advises its use for *blepharitis* in the following mixture:

R

Sol. boroglycerid. 25 per cent.	0.610 (m.x),
Ung. aquæ rosæ.	3.88 (ʒj).

In *herpes of the cornea* the following salve is recommended as an application to the vesicles:

R

Ungt. zinci oxidi	22.50 (5vj),
Boroglyceridi	7.50 (5ii),
Phenol.	1.75 (gr. xxvi).

H. G. Goldberg (p. c.) uses this agent in 50 *per cent.* solution in any stage of *trachoma* and prefers it to the ordinary remedies.

### **Brenzcaïn.**

*Guaiacolbenzyl ester.*

Occurs in colorless crystals soluble in alcohol, ether and *vasogen* (q. v.). It is a *local anesthetic of doubtful utility* in ophthalmology. Said to be useful in the *cataphoresis of cocaine* (hydriodide) (q. v.).

### **Brown Ointment.**

This is a name I have given to the dilute citrine ointment of the B. P. (*ungt. hydrarg. nitratis*, U. S. P.) when prepared with cod-liver oil instead of neat's-foot oil of the British or the lard of our own pharmacopeia.

When thoroughly mixed it should be exposed to the air in a protected jar for at least three weeks, stirring it every day or two, until the yellowish-white-brown ointment turns almost black-brown.

In the course of a month after preparation mercuric iodide (or still more complex organic compound) is formed which joins with some constituent of the oil to convert the original mixture into a smooth, oily, seal-brown mixture of the consistence of molasses and a decided odor of fish. In winter, or if in full strength it proves too irritant, I am in the habit of reducing it with additional cod-liver oil. For all these purposes I generally keep on my treatment table three strengths of brown ointment, the strong, undiluted; a weaker, reduced with ten per cent. of its bulk of cod-liver oil; and a very weak mixture made with twenty per cent. of cod-liver oil.

This salve I almost always use myself as an office application in most forms of chronic blepharitis and blepharo-conjunctivitis and invariably in conjunction with massage (q. v.). I find that the act of rubbing it into the sac with the fingers prevents the pain and smarting that follows its use without massage. After a thorough massage, during which the expressed strings of mucus should be coaxed out of the sac, the excess of ointment must be wiped from the lid edges with cotton and the patient ordered to bathe the eyelashes clean of remaining ointment with hot water an hour or two after the treatment. Care should at the time be taken to prevent any of the ointment from touching the clothing, as it makes an almost indelible stain. Most cases of simple hypertrophy of the lid tissues and chronic blepharitis begin to improve after the daily use of this agent for a week or two.

**Burow's Solution.**

(See *Aluminium acetate*.)

**Cacao.**

*Oleum theobromatis. Oleum theobromæ.*

Incorrectly, "cocoa" butter.

Fixed oil expressed from the roasted seeds of *Theobroma cacao*.

J. C. Roberts (p. c.) uses heavy ointments and *medicated bougies* in the treatment of stenosis of the lachrymal duct. He prescribes a salve with a coca butter base. Following the passage of the probe a lachrymal syringe is loaded with this ointment medicated with protargol  $\frac{1}{2}$  per cent. argyrol 10 per cent or, occasionally, zinc sulphocarbonate (q. v.). The syringe is introduced well into the duct and slowly withdrawn as the contents are expressed so that duct and sac are kept dilated and medicated while the ointment is slowly melting.

**Cade, Oil of.**

*Oleum Cadini. Oil of Juniper.*

A clear, brown, thick liquid obtained by the destructive distillation of juniper wood. It is practically insoluble in water; slightly in alcohol; entirely soluble in ether and chloroform.

Preparations of tar-like oils have long enjoyed a reputation in ciliary blepharitis. Schmidt-Rumpler advises for this purpose a 50 per cent. mixture of oil of cade in petrolatum, to be applied to the lid edges at night time, or the following formula will be found useful:

**R**

Olei cadini	1.5 (gr. xxiii)
Zinci oxidi	4.0 (ʒj)
Vasellini	10.0 (ʒ iiss)

**Cadmium Salicylate.**

$(C_6H_4)(OH)CO_2$  Cd.

Tabular crystals, colorless, slightly acid, soluble in 68 parts of cold water, made by the action of salicylic acid on cadmium carbonate.

A 1 per cent. aqueous solution of this drug has been recommended by Cesario (62) as an eyewash in infective keratitis and conjunctivitis associated with much secretion of pus or mucus. I have had no experience of it.

**Cadmium Sulphate.**

$CdSO_4$ .

Colorless crystals, soluble in water and alcohol. It is a decided astrigent and antiseptic and has been recommended as a *substitute for zinc sulphate* (q. v.) in collyria in 10 per cent. solution.

A proprietary collyrium called *Osmosine*, said to be effective in "any affection of the eye from inflamed, or common tired, or sore eyes,

to the most serious disease of that organ," has been advertised as containing *cadmium sulphate*, hydrastin, boric acid, glycerine and water. I know nothing of its real value.

**Calcium Hypochlorite.**

(See *Lime, chlorinated.*)

**Calcium Permanganate.**

(See *Lime permanganate.*)

**Cali.**

*Pseudo-calabar bean. Horse-eye beans. Bread-nut berry.*

The nut of *Mucuna urens* contains *pseudo-physostigmine*, a miotic resembling *eserine*. Its exact (comparatively) value as a sialogogue and *pupil contractor* has not, so far as I can learn, been worked out.

**Calomel.**

*Mercurous chloride. Subchloride of mercury. HgCl.*

This well-known remedy is a fine, odorless, tasteless, smooth, heavy, white, impalpable powder, which the microscope reveals as minute, needle-like crystals. It is insoluble in water but exposed to boiling water it decomposes into metallic mercury and the bichloride. Perhaps its effects upon the eye are due to this gradual decomposition and the formation of minute quantities of mercuric chloride.

*Calomel in crystals* is of considerable interest to the chemist, as it has always been looked upon as occurring as an amorphous powder. The new crystalline form is manufactured by the interaction of mercuric chloride and lithium sulphite.

An ophthalmic surgeon,\* who has given the substance a trial, considers it a great improvement on the ordinary variety for ophthalmic use, as it is more adherent and is decidedly less irritating than ordinary calomel as a dusting powder for eye treatment. It is interesting to note that the specific gravity of this new calomel is only 4.5 to 5, as against ordinary calomel, 6.5 to 7. This probably explains the reason of the superior adhering quality. The salt, either in the form of powder alone, or mixed with a little sterile boric acid powder or starch or an ointment (5 to 10 per cent. strength), should certainly be worth a thorough trial by the ophthalmic surgeon. It is manufactured by W. Martindale, 10 New Cavendish St., London, England.

It is well to remember that neither calomel nor any other salt of mercury should be applied to the conjunctival sac if iodides are being taken internally lest that irritant, mercuric iodide, be formed.

This remedy has enjoyed a considerable vogue in Europe as a

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\*See the *Ophthalmoscope*, Nov., 1907.

powder for dusting ("flicking" it from the end of a camel-hair pencil or blowing it through an insufflator) over the eyeball and into the sac in phlyctenular and other diseases of the conjunctiva and cornea. It is less frequently employed than formerly. Under the name *aqua ophthalmica nigra* it was used by von Graefe (49) in purulent conjunctivitis. He advised the following formula:

℞

Ext. hyoscyami	1.0
Calomelanos	0.6
Aquæ rosæ	30.0
Aquæ calcis	100.0

A reaction follows with the formation of the black mercurous oxide.

Klein (51) reports the successful employment in the after-treatment of trachoma granulations of one part of calomel thoroughly incorporated with five parts of powdered cane sugar (q. v.). The mixture is dusted on the everted lids as usual.

A. Duane (p. c.) believes that when dusted into the eye it is of service not only in *phlyctenular conjunctivitis*, but also in *all forms of superficial infiltrating keratitis*. Of course, in applying it, he makes sure that the patient is neither taking iodides nor has been taking them recently.

#### **Calomelol.**

This is a trade name for the *soluble, colloidal forms of calomel* containing albuminoids. It is marketed as a white-gray, odorless, tasteless powder containing 80 per cent. of mercurous chloride and 20 per cent. of proteids. It is soluble in water, making an opalescent liquid, but insoluble in alcohol and ether.

The action of calomelol is the *same as that of calomel* (q. v.) but is said to be its *superior because of its solubility in water*, less irritant qualities and because it is distinctly non-toxic. Used as a *dusting powder* it can be mixed with starch, zinc oxide or it can be applied as *calomelol ointment*. This latter is prepared by combining 45 parts of calomelol with 55 of lard.

#### **Camphoid.**

A substitute for *collodion* (q. v.). A solution (1 in 40) of *pyroxylin in equal parts, by weight, of camphor and absolute alcohol*. May be used as a vehicle for application to the skin of such drugs as *iodoform, phenol, salicylic acid, resorcin, iodine, chrysarobin, and ichthyol*. Iodoform dissolves in it to the extent of 1 in 10. The preparation dries in a few minutes, leaving a film, which is not easily washed off.

Very useful as a protective after operations on the lids and in wounds about the eye.

### Camphor .

This is a retene,  $C_2H_{16}CO$ , obtained from all parts of the *Cinnamomum Camphora*. It is a white, translucent, tough substance with a peculiar odor, slightly soluble in water, very soluble in alcohol, ether and various oils.

Camphor and its compounds are *incompatible with* carbolic acid, resorcin, menthol, salol, salicylic acid, potassium permanganate and most concentrated solutions of salts.

Gum camphor has been used in ointments or dissolved in spirituous fluids to form eye liniments but its employment in this way is, for obvious reasons, restricted. The following formula is intended for *acne palpebrarum*:

R

Sulphuris	1.0 gm. (gr. xv)
Camphoræ	
Olei olivæ	āā 0.6 gm. (gr. ix)
Unguenti rosati (P. G.)	15.0 gm. (℥ss).

Camphor water has always been a favorite menstruum in collyria although the gum is very slightly soluble in water, even with the aid, as in the official *aqua camphoræ* (q. v.), of magnesia levis and other adjuvants.

I am in the habit of prescribing camphor water made after the German method. A piece of camphor or, better, a number of small pieces of camphor in a muslin bag are suspended in a gallon bottle three-fourths full of sterile, distilled water. The bottle is shaken three or four times daily. At the end of a week the camphor bag is withdrawn and the water decanted as needed.

It is mildly astringent and stimulating and as such is often prescribed in the slighter forms of conjunctivitis. As Spirits of Camphor it may be rubbed over the forehead, or the fumes allowed to rise from a few drops in the palm of the hand into the open eye, for the temporary relief of ocular headache.

### Cantharides.

*Spanish flies.*

This preparation of the dried beetle—*Cantharis vesicatoria*—owes its powers to *cantharidin* present in the animals to the extent of 0.17 to 1 per cent.

When it is necessary to apply a blister to the ocular neighborhood this remedy is best employed in the form of *cantharidal collodion*,



although the "paper" cerate or plaster may be used. Any of these takes about 5 hours to produce vesication. After the application has remained in situ sufficiently long to blister, the vesication may be much increased by following it with a poultice. The serum should be removed from the pendant bleb by pricking it, after which a soothing cerate should be applied.

I much prefer the *cantharidal collodion*; it is more certain, more cleanly, more easily controlled and localized and probably less painful than the other forms of the "fly" blister.

Blisters are useful as counterirritants and local depletants and as such have a place in ocular therapeutics.

#### Caprenalin.

This is the trade name (Wyeth) of a preparation combining the *analgesic, hemostatic and blood-pressure raising properties of supra-renal extract*, intended for use especially in ophthalmic operations. The blanching of the conjunctiva occurs after the instillation in a minute or two and its effects last about a quarter of an hour. It is also recommended as an adjunct (for intensifying their medicinal effects) to *cocaine, pilocarpine, eserine, atropine, eucaine*, etc. Caprenalin is sold in vials containing one grain each or in glass-stoppered bottles containing one ounce of an aseptic 1:1000 solution.

#### Carbolic Acid.

(See *Phenol*.)

#### Carron Oil.

*Linimentum calcis, U. S. Lime liniment.*

A bland, lime-soap emulsion which should be freshly prepared from equal parts of *lime water* and *linseed oil*.

This well-known application to *recent burns* forms an excellent application on *sterile lint or gauze* to these accidents affecting the lid skin and neighborhood of the eye. If it should come in contact with the ocular structures no harm is done.

It takes its popular name from the iron works in England where it had its origin. It has long been in use as a popular dressing for *superficial burns* and constitutes a readily applied and effective non-antiseptic remedy that rapidly allays the accompanying pain. If there has been extensive destruction of tissue, this remedy should be avoided, as it is not only difficult to remove, but forms a covering beneath which bacteria may proliferate safe from the reach of antiseptics.

#### Castor Oil.

*Oleum ricini.*

The fixed oil expressed from the seeds of *Ricinus communis*. This is a viscid, transparent, pale-yellowish liquid with a faint odor and of-

fensive taste. It deposits whitish flakes, after becoming turbid generally, as the freezing point is reached. Its chief adulterations are other fatty oils—rapeseed, cottonseed and corn oil.

That portion of castor oil that remains clear at the freezing point makes the best solvent for the alkaloids used in ophthalmology. Its bland, viscid properties also render it peculiarly valuable for instilling into the conjunctival sac. Green was the first to suggest that a solution of homatropin in castor oil, inasmuch as in the sac it gives up its alkaloid gradually, being slowly absorbed by the ocular tissues, made the best method of prescribing it in determining refractive errors.

J. S. Kirkendall (p. c.) finds the best results to flow from *atropine* when this oil is used as a solvent. He uses the following formula:

R

Atropiæ (alkaloid)	gr. vi-viii
Olei. ricini.	fl. ʒi

To be dissolved by the aid of gentle heat; one drop to be instilled into the eye once or twice a day.

Castor oil internally—daily for 10 days in one fluid ounce doses—will be found of considerable value in supraorbital neuritis and other forms of ocular neuralgia.

#### **Catalpa.**

*Bean trec. Cigar trec. Candle tree.*

The parts used in general medicine of *Catalpa* are the bark and fruit, the latter two-celled pods a foot to eighteen inches long and of the thickness of the little finger. So far as I can learn the fresh juice from the root of this well-known tree is the only part used in ophthalmic therapeutics. Dropped into the eye as a *collyrium* it is said to be valuable in treating *trachoma* and other forms of chronic ophthalmia.

#### **Ceresin.**

A hard, white paraffin prepared from ozokerite or earth wax. It has a melting point of about 130° F. It enters, like most other paraffins, into various eye ointments.

#### **Cerevisine.**

*Yeast. Brewer's yeast.*

Viscid liquid or soft mass consisting of the cells and spores of *saccharomyces cerevisiæ*. It is supposed to have an antiseptic action due to the *enzymes*, especially *zymase* and *invertase*, present.

Webster Fox (*Text-book*, p. 555) advises the use as a germicide in gonorrhœal ophthalmia of cerevisine in 25 per cent. solution. It is to be instilled into the eye 4 times daily.

**Chamomile.**

The dried flower-heads of *Anthemis nobilis*.

Although best known as a lay remedy in the form of "tea," the simple infusion is often prescribed, especially in Continental Europe, as a hot fomentation, a compress (hot or cold) or as a detergent wash in painful diseases of the eye. I suspect that the efficacy of the remedy, applied in this fashion, is chiefly due to its thermic qualities, although the flowers contain one per cent. of a volatile oil said to have medicinal properties, I have long discarded it in favor of more cleanly applications, such as normal salt solutions, one per cent. sodic bicarbonate or two per cent. boric acid.

**Cherry Laurel.**

The leaves of *Prunus laurocerasus* is the part used in medicine. They contain 1.3 per cent. of laurocerasin. When the leaves are distilled in the making of *cherry-laurel water* the distillate should contain about one-tenth of one per cent. of hydrocyanic acid. It has an agreeable odor of prussic acid and in ophthalmic therapy is almost entirely used as a vehicle for the exhibition of other agents. It is almost exactly like bitter almond water (q. v.)

Brenzcin (q. v.), made by the action of anhydrous hydrocyanic acid on choral, has been used as a *substitute for cherry-laurel or bitter almond water owing to its exact dosage*. One part dissolved in 160 parts of distilled water makes bitter-almond water of the same strength of the P. G. The only question that arises is whether in *collyria* it is as free from irritating effects upon the eye as the best examples of this vehicle.

**Chloral Hydrocyanate.**

*Trichlorolactonitrile.*

Made by the action of anhydrous hydrocyanic acid on chloral and forms colorless crystals with an odor of both chemicals.

It may be used as a satisfactory *substitute for cherry laurel or bitter-almond water owing to its exact dosage*. One part dissolved in 160 parts of distilled water makes *bitter-almond water the strength of the P. G.* The only question that arises is whether in *collyria* it is as free from irritating effects upon the eye as the best examples of these important vehicles. (See *Brenzcin*.)

**Chinosol.**

(See *Quinosol*.)

**Chloral Hydrate.**

The prescription of chloral hydrate as a local remedy in ophthalmology seems to be quite rare and there is no reason to think that it is

of any especial value. However, as an antiseptic compress and detergent Buchardt advises the following mixture:

R

Acid. salicylic.	0.70
Chloral. hydratis	1.50
Acid. boric	30.00
Sol. aquæ chlorinatæ (1:20)	1000.00

### Chloretone.

A trichlorobutylalcohol.  $C_4H_7OCl_3$ . Prepared from acetone and chloroform, it appears as snow-white crystals with a camphorous taste and odor. It is soluble in cold water to the extent of 0.80 per cent.; freely soluble in ether and oils.

This useful antiseptic and analgesic is often combined with cocain and other alkaloids, generally in the proportion of 2 per cent. It is a favorite remedy of my own for the relief of the burning and smarting that so often accompany the lid hyperemias of eye-strain. The formula I generally employ is:

R

Chloreton.	0.10 grm. (gr. $\frac{7}{10}$ )
Sodii boratis	0.50 grm. (gr. $7\frac{1}{2}$ )
Aquæ dest.	30.0 c.c. (fʒj).

G. E. Blackham writes me that he always uses a *saturated solution of chloretone* as a menstruum for making up solutions of cocain, *atropia* and other alkaloids or salts for *collyria*. He finds it preserves them better than any other antiseptic and knows of no contraindication to its use.

As a collyrium in *irritative affections of the conjunctiva* Nelson Black (p. c.) prefers the following formula:

R

Chloreton.	0.075
Sodii borat.	0.25
Sol. suprarenalin. 1-1000	2.00
Sol. sodii. chlor. norm.	āā 15.00

## CHAPTER XXIV.

### REMEDIAL AGENTS EMPLOYED IN THE LOCAL TREATMENT OF EYE DISEASES.—CONTINUED.

*Chlorine Water—Cineraria Maritima—Citrine Ointment—Cocaethylene—Cocaine—Cocarenaline—Codrenin—Cod Liver Oil—Cold Cream—Collargol—Collyrium Astringens Luteum—Coniine—Conium—Copper Acetate—Copper Citrate—Copper Sulphate—Copper Sulphocarbolate—Copper Ammonio Sulphate—Cosmoline—Crede's Ointment—Creolin—Crocus—Cumarin—Cuprocitrol—Cuprol—Cuprum Ammoniatum—Cydonia—Daturin—Delphinium Consolida—Dermatol—Diachylon Ointment—Dionin—Dobell's Solution—Duboisine—Ecgonine—Egg Yolk Oil—Enzymol—Erythrophleine Hydrochloride—Ephredrine—Ephredrine-pseudo—Epinephrine Hydrate—Ergot—Escorcin—Eseridine—Eserine.*

#### **Chlorine Water.**

*Aqua chlorata, P. G. Aqua chlori.*

An aqueous solution of chlorine containing from 0.4 to 0.5 per cent. of the gas. It is a clear, yellow-greenish fluid, with the acid smell of free chlorine, easily decomposing into hydrochloric acid and oxygen. It is a stimulating, disinfectant mixture whose virtues are due to the chlorine it contains.

This agent is a very old (in Europe especially a favorite) professional and lay application to the eye as a germicide and astringent. Indeed it is by some surgeons believed to be our most reliable minor antiseptic. I have been deterred from its use in collyria mainly because of its uncertain action, its irritant character and liability to decomposition. Moreover, in my opinion, for American patients several substitutes for it are quite as effective and more comfortable. If used at all it should be freshly prepared and protected from the light. A 5 per cent. solution is sufficiently strong for ordinary purposes, although abroad it is used in much larger proportions. Chlorine water was much used by von Graefe in many conjunctival diseases, especially in conjunctival phlyctenules, for which he prescribed two or three instillations daily of a 50 per cent solution with compresses of the same remedy. As a compress, a teaspoonful to a cupful of hot water is about the correct quantity. This may be applied for ten to fifteen minutes at a time, three or four times daily.

As a germicide-substitute for mercuric bichloride Percy Frieden-berg (p. c.) prefers the fresh solution in the proportion of a fluid drachm to a fluid ounce in a pint of distilled water. It is better to begin with the weaker solution. He instills the mixture into the eye with a pipette every hour, if necessary. See, also, *lime chlorinated*.

#### **Cineraria Maritima.**

*Senecio cineraria.* Dusty Miller.

I am in doubt as to whether this well-known plant, whose *tincture*, *fluid extract* and *fresh juice* have for many years past been recommended as a *local application for the cure of cataract of all kinds*, should not find a more appropriate place among the list of quack remedies (q. v.). Still, a few respectable names have been associated with its employment in that capacity and it only remains to be said that the *instillation into the conjunctival sac of a preparation* of this or any other member of the *Senecio* family has about as much effect upon the resolution or dispersal of opacities due to organic changes in the lens as pouring the same down the back of the patient's neck!

#### **Citrine Ointment.**

*Ungt. hydrarg. nitratis*, U. S. P.

Made by the action of nitric acid on mercury to which lard is gradually added. This yellow salve is occasionally applied to the lids, but only when further diluted with lard or a similar excipient.

Dilute ointment of the nitrate of mercury is official in the British codex, and is made from the stronger ointment which is diluted with four times its weight of soft paraffin.

#### **Cocaethyline.**

*Ethylbenzoylecgonine.*  $C_{18}H_{25}NO_4$ .

It is the *ethylic combination* with *eccgonine* (q. v.) just as *cocaine* is the *methyl compound*.

This *analogue of cocaine* occurs as colorless crystals whose taste is followed by numbness of the tongue and lips. It results from the action of iodide on benzoylecgonine. It is almost insoluble in water; soluble in ether and alcohol. As a *local anesthetic* its action resembles cocaine but is much milder than that drug.

#### **Cocaine.**

*Erythroxyline.* *Methyl-benzoyl-ecgonine.*

Derived from the leaves of *Erythroxylum coca* and having the formula  $C_{17}H_{21}NO_4$ , is the best known and one of the most useful local anesthetics we possess. This alkaloid is present in coca to the extent of about one-half of one per cent. and occurs in the shape of colorless prisms, soluble in 600 parts of water, five of alcohol, twelve of olive oil; insoluble in lard and vaselin. The hydrochloride is its best



known salt, although the benzoate, borate, citrate, hydrobromide, hydriodide, lactate, nitrate, tartrate, salicylate, phenate, oleate, stearate (best for ointments), and sulphate are well known. The National Formulary recommends *cocaine borate* instead of the hydrochloride in solutions intended for ocular use on account of its greater stability.

The most frequently used *incompatibilities with cocaine and its salts* are its combination in solution with zinc sulphate and sodium borate, both of which precipitate it.

As the hydrochloride is incompatible with silver salts cocaine nitrate should be used in lieu of the hydrochloride when argentic compounds are prescribed with it.

In the usual dosage, 3 to 5 per cent., it dilates the pupil moderately, is a feeble cycloplegic, produces anemia of the conjunctiva and is a dangerous poison. The drug greatly increases the action of other alkaloids with which it is instilled into the conjunctival sac, probably because its desiccating and loosening action on the anterior corneal epithelium enables the solution to reach more easily the *substantia propria*. *The eyes should always be kept closed during the first stages of cocain instillation* as this largely neutralizes the hurtful action of the drug on the cornea. Michel goes even further than this in claiming that the exfoliation of the pavement epithelium may be so marked as to justify calling the condition cocain keratitis and advises one to cover the eye with a moist compress when strong solutions are used or the drug applied for any length of time. It is claimed that this agent may precipitate an attack of glaucoma, while even from simple instillations into the eye of a comparatively weak solution toxic symptoms (vertigo, pallor of the face, fainting, thick speech, weak pulse, loss of consciousness, etc.), may occasionally show themselves, requiring alcoholics, amyl nitrite inhalations and other stimulation for their relief.

Although numerous local anesthetics, especially eucain (q. v.) and holocain (q. v.), have been advised as substitutes for cocain it is still the favorite agent in operative procedures. I prefer (as giving the maximum anesthesia with the least cocain) for the average ophthalmic operation the following formula:

R	
Cocain. hydrochlor.	gr. xx.
Holocain. hydrochlor.	gr. v.
Aquæ dest. et steril.	ʒj.

Instil one drop every three minutes for 12 minutes.

Although several observers believe that the anesthetic action of

solutions of cocain, both of the alkaloid and of the salts, is lessened or destroyed by boiling, this view is not held by C. R. Holmes who always sterilizes his solutions in this way, and has used it for operations upon the eye, ear and nose thousands of times. In his experience it is the rarest thing to find that the drug is not efficacious, and in these rare cases he has attributed its lack of action to the idiosyncrasy of the patient.

Wintersteiner\* reported in 1906 that in spite of alleged substitutes, cocaine is still the sovereign local anesthetic for eye work. Sommer\*\* has also had considerable experience of the so-called substitutes for cocaine, has given them all a thorough test and believes them to be inferior to cocaine. Without ignoring the toxicity of cocaine, the substances which have been suggested in its stead are, he thinks, all more or less make-shifts, and not substitutes.

Cocaine is of good service in the intra-muscular injection (q. v.) of mercury salts, to diminish or abolish pain. Since the simultaneous use of cocaine and mercury salts leads to the formation of sparingly soluble double combination, P. Salmon\*\*\* advises that the injections be made at different points, injecting the cocaine solution more deeply, the mercurials superficially. In this way it is possible to inject large quantities of the mercury solution without pain, and so reduce the total number of injections. The dose recommended by the author is 1 c. c. (m 16) of a 1 p. c. solution of cocaine.

#### **Cocarenaline.**

(See *Adrenaline*.)

#### **Codrenin.**

(See *Conephrin*.)

#### **Cod Liver Oil.**

*Oleum jecoris aselli. Oleum Morrhuæ.*

A fixed oil obtained from the fresh livers of *Gadus morrhua* and other fish. The purest oil is of a pale-yellow color, with a bland, fishy taste and smell.

Aside from its internal administration I would like to draw attention to this oil as an excipient for and diluent of ointments. I have found it of great value in the preparation of "brown" ointment (q. v.) a stimulant mixture of considerable utility in massage.

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\*Merck's *Annual Reports*, 1906, p. 91.

\*\**Wochenschrift für Therapie und Hygiene des Auges*, 1907, No. 51, p. 402

\*\*\**Semaine médicale*, 1907, No. 3, p. 34.

### Cold Cream.

*Unguentum aquæ rosæ. Unguentum emolliens. Ceratum galeni.*

Prepared with spermaceti, white wax, expressed oil of almond, finely powdered boric acid and stronger rose water.

Although this preparation is not always made according to the official formula yet it generally forms a valuable base for eye ointments and is alone a useful application to the lid edges in diseases of those organs. Its consistency for medical purposes is improved if the proportion of white wax be varied according to the temperature or the season of the year. If it is to be used as a vehicle for metallic salts the boracic acid may be omitted.

### Collargol.

(See *Argentum colloidalé.*)

### Collodion.

*Flexible Collodion. Collodium. Contractile collodion. Flexile collodion.*

This useful agent is made from one part of *pyroxylin*, (gun-cotton) 12 parts of 90 per cent. *alcohol* and 36 parts of *ether*. It is a useful solvent of iodoform, cantharides, salol, salicylic acid and other agents. Both pure and mixed with one of these remedies it is commonly used in *wounds* and other injuries about the eye. As a protective for operations upon the lid skin it is often invaluable. *Flexible collodion* contains Canada turpentine and castor oil, and makes a more elastic film than the older contractile collodion. (See, also, *Camphoid.*)

*Formalized gelatin* is largely used in Great Britain as a *substitute for collodions*. Ten per cent. gelatin solution in water is stored in wide mouth test tubes holding three ounces each. The tubes are plugged with cotton wool and sterilized at 100° C. for 15 minutes on three successive days. When required for use they are melted in a water bath and 1 drachm of *formalin* added. The mixture contains 2½ per cent. of commercial formalin.

Formalized gelatin is applied with a brush or swab on the top of the dressing beyond the limit of the wound and the dressing is thus held in place without a bandage.

### Collyrium Astringens luteum.

(See *Horst's Eye-water.*)

### Conephrin.

A trade name given to one of the numerous combinations of *cocain* and *suprarenal extract* to be used locally or by hypodermic injection in operations on the anterior part of the eyeball. The ingredients are present in practically the same proportion as in *codrenine*.

**Coniine.**

$C_8H_{17}N$ . *Conicine*. *Cicutine*.

Alkaloid from *Conium maculatum*. [Poison Hemlock; Spotted Hemlock; Poison Parsley; Spotted Cowbane] one of the most poisonous of the Umbelliferæ. It is a colorless, *oily liquid* of a mouse-like odor that darkens with age and exposure. The soluble hydrobromide and hydrochloride are the most important salts of this fluid alkaloid.

Its use in the eye is limited; in *scrofulous ophthalmia* (q. v.) it is occasionally employed as a collyrium. It relieves the pain and palpebral spasm incident to the disease. When employed in this way it is used as a lotion, from 1 to 4 minims (0.05-0.25 c.c.) being dissolved in a fluid ounce (30.00) of water, or water containing ten per cent. alcohol.

**Conium.**

(See *Coniine*.)

**Copper Acetate.**

*Cuprum aceticum*. *Copper verditer*. *Crystallized verdigris*.

Forms deep, bluish-green, efflorescent crystals, quite soluble in water and alcohol.

Copper acetate is an irritant-astringent. As a lotion it has been recommended in the *subacute and chronic forms of conjunctivitis*, the collyrium ranging in strength from 1:100 to 1000 of distilled water.

**Copper Citrate.**

(See *Cuprocitrol*.)

**Copper Sulphate.**

*Cupri sulphas*. *Blue stone*. *Blue vitriol*.  $CuSO_4$ .

This well known salt occurs in deep-blue, transparent, short, odorless prisms, with an acid reaction and an acrid, astringent taste. It dissolves in 2.2 parts of water; 3.5 parts of glycerin. Pencils of the salt may be made by fusing together 1 part of potash alum and 2 parts of copper sulphate.

The soluble salts of copper are *incompatible with* a number of ophthalmic remedies: the alkalies, iodides, lead acetate, lime water, sublimate, silver nitrate, as well as the vegetable infusions and tinctures.

This renowned remedy has recently (and properly) fallen into disuse as a treatment for trachoma and chronic follicular conjunctivitis owing to the pain following its application in the solid form and because we have at our command so many other remedies more humane and equally efficacious. If used at all in this form it should be applied only by the surgeon or someone instructed by him. The

crystal or pencil should have a smooth point and the eye ought to be anesthetized with a single drop of a weak (2 per cent.) cocain or holocain (one-half per cent.) solution. The crystal point should now be very gently rubbed over the diseased area, after which the sac should be irrigated with warm sterile water or normal salt solution, followed by the instillation of a few drops of glycerin. This remedy is indicated in trachoma when there is little secretion.

Cupric sulphate ointment (1 to 3 per cent.) made with vaseline or the glycerine ointment of the German pharmacopeia is an equally effective and less barbarous method of employing the salt, as is the combination with alum—to make an aluminated copper. Indeed, upon the rather rare occasions that I desire to apply copper sulphate to the conjunctiva I generally use the so-called *lapis divinus* (q. v.).

As an astringent eyewater for granular conjunctivitis the following formula is often used:

℞	
Cupri sulph.	gm. 0.5 (gr. viiss)
Glycerin.	
Aquæ dest.	āā gm. 10.0 (5iiss)

As an ointment:

℞	
Cupri sulph.	gm. 0.1 (gr. iss)
Petrolati	gm. 5.0 (5i¼)

Hirschberg uses as a menstruum (instead of the foregoing) glycerin ointment to which he adds a little cocain.

A. E. Prince was the first to advise use of a *saturated solution of this salt in glycerine and its subsequent employment in various dilutions for the majority of cases of trachoma*. He gives the patient a 10 per cent. mixture of the copper-glycerine in water for home treatment, directing them to dilute it further if necessary. T. A. Woodruff (p. c.) reports a number of cases of trachoma treated in this fashion with the best results.

D. T. Vail (p. c.), in *blepharitis ulcerosa*, beats the white of a fresh egg with a few crystals of bluestone until turquoise-colored curds form. This is applied as a poultice, after thorough cleansing, all night for three nights.

A. Duane (p. c.) advises *the use of bluestone as the principal local application for trachoma*. As Fuchs says, the presence of corneal infiltrates is an indication and not a contra-indication for its use.

W. B. Anderson (p. c.) prefers the oxy-chloride of copper by

electrolysis or *cataphoresis*. He has found this agent acts more satisfactorily than any other copper salt. The technique is as follows:

Apply to the everted lid, which has been previously cocaineized, a copper eye electrode attached to the positive pole of a galvaic battery, using about  $3\frac{1}{2}$  milliamperes of current about five or ten minutes. He says, *about*, advisedly, because some patients are more sensitive to this agent than others. Instead of using a milliamperemeter he permits the patient to regulate the current by the amount of pressure with which the negative sponge electrode is applied. Experience has taught him that better results are had by brightening the eye electrode before each application. This application is repeated every five days. By this method one does not have the destruction of epithelium that is sustained when copper sulphate stick is used. Moreover, the cataphoretic copper, which is almost as powerful a germicide as bichloride of mercury, penetrates the deeper structures of the lid and reaches every follicle. So efficacious is this measure that the incurable cases are practically nil. He has found it especially useful in the non-inflammatory cases of long standing in which the trachoma follicles are disseminated through the stroma, as in patients of lymphatic temperament. In such instances no other treatment has in any way compared with this in his hands.

#### **Copper Sulphocarbolate.**

This salt occurs as green, prismatic needles soluble in both water and alcohol. It is not extensively used in ocular diseases but has been recommended in all *purulent infections of the conjunctiva* as a collyrium in the proportion 1:400-200 of water.

#### **Copper, Ammonio-Sulphate of.**

(See *Cuprum ammoniatum*.)

#### **Cosmoline.**

*Paraffinum molle. Albolene. Saxoline. White vaseline. Soft paraffin. Adeps petrolei. Paraffin jelly. Petrolatum molle, U. S., 1890. Purified vaseline. Vaseline.*

The foregoing are some of the official and trade names of that semi-solid, greasy, neutral, odorless and almost tasteless mixture of soft paraffins, both yellow and white, so well known to the public. It is said that the action of the vegetable alkaloids, such as cocaine and morphine, is materially diminished when any form of it is used as an excipient, and that cocaine hydrochloride cannot be used in this way. The name *cosmoline* is applied to a white or purified proprietary petrolatum. See *Petrolatum, U. S.*

#### **Crede's Ointment.**

(See *Collargol*.)



**Creolin.**

This is a name given to several coal-tar products, allied to phenol and made soluble by the action of soap on cresol. The creolins are decidedly disinfectant and antiseptic. They are dark-brown, syrupy fluids with a tarry odor; soluble in ether, very little soluble in water.

As an eyewash creolin is prescribed for chronic and some acute forms of catarrhal conjunctivitis in the proportion of 1:1000 to 200. Diluted one-half with distilled water it is recommended as an antiseptic injection in dacryocystitis with muco-purulent secretion.

When corneal complications set in during an infective conjunctivitis a few drops of a one per cent. creolin solution once or twice a day has been strongly recommended in conjunction with other remedies.

A. C. H. Friedmann (p. c.) has found *creolin* of considerable value in cases of *conjunctival edema* from unknown causes. He prescribes it in cold applications of a half per cent solution.

**Crocus.***Saffron.*

The dried stigmas of *Crocus sativa*. The saffron of pharmacy is a flattened, tubular collection of thread-like stigmata,  $1\frac{1}{4}$  inches long, of an orange-brown color, a strong, peculiar, aromatic odor, and a bitter, aromatic taste. They furnish an aromatic volatile oil, a yellow glucoside called *crocin*, and other constituents. One part of saffron will color yellow 100,000 parts of water.

Saffron has long been used as a collyrium in the form of a colored infusion, 2 drams to a pint of water. It also enters into the *tinctura opii crocata* P. G. (q. v.) which, when mixed with 2 or 3 times its bulk of water, is not an uncommon eyewater, useful in chronic catarrh of the conjunctiva. The saffronated tincture of the German pharmacopeia is substantially the same as our vinum opii except that saffron is added to the mixture.

In the various forms of *conjunctival catarrh* (q. v.) C. R. Holmes (p. c.) uses a collyrium containing  $\frac{1}{4}$  grain of this remedy to the fluid ounce.

**Cumarin.**

The active principle of the Tonka, or Tonquin, bean (in which it is found to the extent of two per cent.), appears as colorless, prismatic crystals, having a fragrant odor (like vanilla) and a bitter, aromatic taste.

The only use to which, so far as I am aware, this agent has been employed in eye disease is in conjunction with iodoform whose disa-

greeable odor it disguises in the production of the deodorized variety of the latter.

### **Cuprocitrol.**

*Citrate of copper.*  $C_2C_6H_4O_7 + 2H_2O$ .

A greenish powder, slightly soluble in water.

I give this salt its proprietary name as it is best known as a remedy for *trachoma*, introduced by Merck and recommended as a 5 to 10 per cent. ointment; also with the glycerite of starch.

Lucien Howe (p. c.) prescribes *ten parts of copper citrate to one hundred parts of petrolatum* as a daily application in the granular forms of conjunctivitis with very good results.

L. D. Brose (p. c.) finds the following mixture dusted into the eyes morning and afternoon, followed by massage, to be useful in *chronic trachoma*. He says that it is much less painful than many other applications used in this disease.

R

Pulv. cupri. citratis.	1.00
Pulv. sacchari. alb.	10.00

It is a valuable substitute (generally employed as a 5 per cent. solution) for bluestone in the treatment of *trachoma* and allied diseases. von Arlt (22) also uses it in place of silver nitrate in the form of a 5 to 10 per cent. salve made with glycerin and starch. He applies this mixture (which the patient can easily continue at home) two or three times daily on the end of a glass rod and rubs it into the conjunctival sac. The lids are then closed and massage is employed for about half a minute. The pain is slight and transient. He refers to three cases of pannus in which the trouble disappeared in from 7 to 12 days. It is to be avoided in corneal ulcers and also when the individual is taking iodide of potash.

### **Cuprol.**

*Copper nucleoid. Copper nucleinate.*

An organic compound of copper and nucleic acid, which contains about 6 per cent. of metallic copper and is readily soluble in water. In solutions containing albumen no coagulation is seen on the addition of cuprol. The 10 per cent. solution is generally used, to which it is well to add  $\frac{1}{2}$  per cent. of chlore-tone. It is best to make the solution in warm water. From a solution of this strength there is practically no pain when dropped into the eye, and the minimum amount of conjunctival irritation. Sometimes, after 10 or 15 minutes, a slight burning may be felt, but this is only transient.

This remedy is of value in simple catarrhal conjunctivitis and in

trachoma with pannus. It may be used as a powder, as a 5 per cent. solution or as salve.

Ray H. Dean (p. c.) employs a 5 per cent. solution in the prolonged treatment of trachoma. He prescribes it dissolved in normal salt solution and directs the patient to instil a single drop of the solution into the conjunctival sac once a day. The lids may, also, be everted and the applications made directly to the conjunctiva with a cotton swab. He orders this remedy especially for persons who live so far away that they cannot come to the office for frequent treatments. As the mixture decomposes readily he prescribes just enough to last for one week.

#### **Cuprum Ammoniatum.**

*Ammoniated copper. Ammoniosulphate of copper.*  $\text{Cu}(\text{NH}_3)_4\text{SO}_4, \text{H}_2\text{O}$ .

This is a deep blue salt, with an ammoniacal odor, which readily loses its ammonia and is converted into the non-crystalline form of cupric sulphate. Its only interest to us lies in the fact that very weak aqueous solutions (1:500 to 1:1000) have been used in purulent conjunctivitis.

#### **Cydonia.**

*Quince seed.*

The seeds of *Cydonia vulgaris* contain much *cydonin*, (mucilage) *amygdalin* and fatty oil, a combination that eminently fits them for use as a soothing emulsion and vehicle for other remedies in collyria.

The mucilage of quince has long enjoyed a reputation for these purposes and will be found quite equal to mucilage of acacia and similar agents.

#### **Daturin.**

The dried leaves of the *Datura stramonium* (Jimson weed, Thorn-apple, Jamestown weed) yield from 0.2 to 0.4 per cent. of *daturin* which is also found in various other species of the genus *Datura*.

This alkaloid is identical with hyoscyamine (or hyoscine) and duboisine and is isomeric with atropia. It is questionable whether it possesses any advantage over atropia which, in its pure state, it closely resembles both in its clinical and physiological aspects.

After scarifying the blood-vessels about the corneal margin in superficial ulcer Webster Fox (Text-book, p, 157) advises the use of the following formula:

**R**

Daturin. sulph.

gr. ss

Acidi. boracici

gr. vj.

Acidi carbolici.

m. j

Aquæ dest.

fl. ʒj.

Five drops into the eye four times daily.

**Delphinium Consolida.***Knight's Spur. Lark's heel. Stavesacre.*

Fluid extract of the flowers of this plant has been used in aqueous solution as a *collyrium* in simple conjunctivitis.

**Dermatol.**(See *Bismuth subgallate*, U. S.)**Diachylon Ointment.***Unguentum diachylon*, U. S. *Hebra's lead ointment.*

This salve is made from lead plaster, oil of lavender and olive oil.

As an application to the lids in eczema and other forms of ciliary blepharitis, this ancient preparation, diluted with some softer excipient, is often used abroad. Perhaps it is better known there as "Hebra's Salve," or "Hebra's diachylon ointment." In the German pharmacopeia equal parts of lead plaster and olive oil are melted together, but a mixture quite as popular is:

℞

Emplast. diachyloni

50.00

Vasellini

15.00

To be mixed in a hot water bath.

**Dionin.***Ethyl-morphine hydrochloride. Codethyline hydrochloride.*

First introduced by Merck under its trade name. It is made by the action of ethyl iodide on morphia. It is a fine, white, odorless, crystalline powder with a slightly bitter taste, soluble in 7 parts of water and four of alcohol. It melts and decomposes at 125° C. (257° F.). It is incompatible with alkalies and their carbonates.

Dionin, for which we are clinically indebted to Wolfberg (see *Peronin*), is one of the most valuable analgesic remedies we possess for the relief and curative treatment of corneal ulcer, acute glaucoma, iritis, scleritis and other inflammatory disease of the uveal tract. The relief given to the pain in most cases is prompt and complete. It may be used hypodermically (as an adjunct to atropia) but is commonly employed as a collyrium in 5 or 10 per cent. solution. The greater the edema of the conjunctiva the more decided is the analgesic action of the agent. I have never seen any ill effects from its local use, even when the conjunctivæ and lids are much swollen, nor when the saturated solution or the powdered drug has been employed at intervals for a long period. Indeed, there is every reason to regard

this drug as among the best of the recent additions to the therapeutic list.

It is good policy for the surgeon to make the first application of dionin himself that he may take note of its effect and thus gauge the strength of subsequent doses, and that he may explain to the patient that the swelling of the conjunctiva and eyelids is a *sine qua non* of the treatment and that these apparently alarming symptoms will shortly subside with benefit, and not harm, to the eye. I have known patients seek the service of "another oculist" because of neglect of this precaution.

It must be remembered, in the administration of dionin, that one should begin with the smallest dose that will produce a decided swelling of the conjunctiva and not increase it until it begins to fail (as it commonly does) to produce the desired chemosis of the conjunctiva or to relieve the pain. I have not found it of much value in the clearing of true scars, although keratitic infiltrates often disappear, especially when used in conjunction with massage with mercurial ointments.

Undoubtedly dionin solutions—5 per cent. is a good average adjuvant—increase the analgesic and other effects of several important alkaloids used in ophthalmic practice. This is notably true of eserine and atropine, and is a most valuable advantage.

Dionin has been shown to have a favorable influence on the healing process after operations and injuries. It also assists the action of atropine and of antiseptic compresses in this way, so much so that in many cases it seems to be indispensable. The action of the preparation in corneal ulcer, opacities and infiltration and (including their after-treatment) has resulted in an acuity of vision as has seldom been attained without the use of dionin. The action of the remedy may be regarded as sufficient as long as its use is followed by chemosis, redness, and by burning sensations for 1-2 minutes afterwards. Under these circumstances it may be instilled once a day; as soon as they decline it is used every second day, or twice a week. The mode of administration must be selected to suit the condition of the eye at the time. It may be dusted in with a brush in the form of a powder, or it may be applied mixed with yellow mercurial ointment.

von Arlt and Foerster both recommend, as one effective means of breaking down adhesions between the iris and the capsule of the lens resulting from iritis, to place some powdered atropine in the sac and then follow it, a few minutes later, by a little powdered dionine.

A combination of dionine with *pyoktanin* (q. v.) has been found useful by Wicherkiewicz in various suppurative conditions of the eye.

A 1:500 solution of pyoktanin is first instilled, and dionine is then dropped in. The latter is used in increasing strength from time to time because of the well-known tolerance that is soon established.

The ointment form of exhibiting dionin is popular with several surgeons who prefer it in the proportion of 0.25 to 0.75 grm. to 15 grm. of petrolatum—4 to 12 grs. to the half ounce.

J. M. Woodson, (p. c.) has had excellent results in the treatment of *corneal opacities* from the local use of dionin in the *form of powder*. He has noticed that the improvement continues as long as the drug produces irritation of the cornea and conjunctiva.

H. V. Würdemann (p. c.) uses it in *powder form* applied to the conjunctival cul-de-sac for the *absorption of intraocular exudates*.

### **Dobell's Solution.**

*Liquor antisepticus alkalinus. Alkaline antiseptic.*

A rather formidable array of drugs is used in this well-known preparation. As commonly published the formula is:

R

Potass. bicarb.	
Sodii benzoat.	āī 32.00
Boracis.	8.00
Thymol.	
Euclyptol.	
Ol. menth. pip.	āā 0.20
Ol. gaultheriæ.	0.40
Tinct. persionis	15.00
Alcohol.	60.00
Glycerin.	250.00
Aquæ dest. ad	1000.00

The directions are to "dissolve the potassium bicarbonate, sodium, benzoate and borax in six hundred and fifty (650) cubic centimeters of water; the thymol, eucalyptol and oils in the alcohol. Mix the alcoholic solution with the glycerin and add the aqueous liquid, then the tincture of cudbear, and lastly enough water to make one thousand (1000) cubic centimeters. Allow to stand a few days, then filter, adding a little magnesium carbonate [or a little purified talc.] to the filter, if necessary, to get a brilliant filtrate."

This mixture is not often used in ophthalmology, but G. E. Blackham, (p. c.) prefers it as a *hot bath to the eye in all inflammatory diseases of that organ*. He employs it as a 5 to 10 per cent. solution for this purpose.



### Duboisine.

The leaf of the *Duboisia myoporoides* (corkwood elm) contains about one per cent. of alkaloids, mostly hyoscyamin, a little hyoscin and another crystalline alkaloid called *pseudohyoscyamin*. As a mydriatic *duboisine sulphate* (probably mixed alkaloidal sulphates) is used as a substitute for atropia, 1 grain to the ounce of water being considered equal to a one per cent. solution of atropia.

This alkaloid is also obtained from several other varieties of duboisia, besides the myoporoides of New Caledonia, e. g., the *D. hopwoodii*, or pituri-plant, of New South Wales and Queensland. The leaves and small branches of the various varieties of duboisia are chewed by the natives as a stimulant. Duboisine is thus probably a mixture of several alkaloids. It is easily dissolved by ether and alcohol but is not readily soluble in water. It occurs as a brownish, hygroscopic substance which is two or three times more powerful than atropia. Merck furnishes it as the hydrochloride, although the N. D. refers to the commoner salt, duboisin sulphate. I have been in the habit of prescribing this drug as a substitute for atropin when the action of that remedy is unsatisfactory, although I am well aware that hyoscyamin differs little or none from it clinically and that it is probably identical with part of it chemically.

### Ecgonine.

This complicated organic acid is the *base of cocaine* (q. v.) and is made from it by decomposition with hydrochloric acid. It occurs as white prisms with a slightly bitter taste, soluble in alcohol and five parts of water.

*Ecgonine hydrochloride* is found as white crystals, soluble in water, very slightly in alcohol. Both agents act as *local anesthetics* but in no respect rival the desirable qualities of *cocaine*, *holocaine*, *enaine* or *acoin*.

### Egg Yolk, Oil of.

A fatty oil obtained by expression from the *yolks of fresh eggs*. Its chief ophthalmic use is, abroad, as a *popular remedy for the removal of corneal opacities*.

### Enzymol.

Trade name (Fairchild Bros & Foster) given to a "purified solution of the proteolytic enzyme," obtained direct from the stomach glands. As marketed it has an agreeable odor and flavor. It digests or converts purulent material into a soluble form which, in turn, is readily removed by irrigation.

J. H. James (p. c.) believes that injected into the sac in cases of *dacryocystitis*, this remedy is very efficient and, in some cases, can be relied upon entirely.

H. M. Lokey (p. c.) uses the following prescription as a part of his treatment of *eczematous blepharitis*:

R

Acid. carbolic.	gr. ii
Sol. adrenalin, chlorid.	m. xxx
Enzymol ad.	fl. ʒi

To be applied to the lids with a cotton swab.

H. D. Bruns (p. c.) advises the use of this agent in *cleansing infected ulcers*. He uses a 50 per cent. solution and employs it, also, as an antiseptic wash for disinfecting the lachrymal sac, as well as the whole conjunctiva.

### **Erythrophlein Hydrochloride.**

Salt of an alkaloid from the bark of *Erythrophleum guinense* or Sassy Bark.

It is a yellowish-white, amorphous powder, soluble in water and alcohol. It resembles digitalis in its general action but *locally is an anesthetic* and has been used as such, as well as to relieve *irritative symptoms* about the eyes in 0.05 to 0.25 per cent. aqueous solution.

### **Ephedrine.**

$C_{10}H_{15}N$ . O.

This is an alkaloid possessing mydriatic powers obtained from a Japanese plant, *Ephedra vulgaris*. As the hydrochloride it occurs in colorless, crystalline needles easily soluble in water, less soluble in alcohol. When used in a 2 per cent. solution one or two drops produce almost complete mydriasis in a normal eye after 50 minutes. The pupillary expansion lasts about 12 hours. It produces very little cycloplegia and no increase of tension. Combined with homatropin it forms a useful mydriatic, called by Merck *mydrin* (q. v.). I am unable to confirm the observation of Groenouw (52) that it increases sufficiently the cycloplegic quality of homatropin as to make the mixture a reliable cycloplegic in refraction work. He uses the following:

R

Ephedrin. hydrochlor.	1.0 gm.
Homatropin.	0.01 gm.
Aquæ dest.	10.0 c. c.

Probably the cycloplegia induced by this mixture is mostly due to the homatropin. The N. D. describes the *mydriasis* as lasting about

as long as that produced by *atropine*; homatropine must have been meant.

### **Ephedrine. (Pseudo-)**

This alkaloid must not be confused with *ephedrine* (q. v.); it is obtained from *Ephedra vulgaris* and is found as colorless crystals insoluble in water. The *hydrochloride* forms yellowish crystals quite soluble in water and as 10 to 12 per cent. solutions acts promptly as a *mydriatic without disturbance of accommodation or refraction*.

### **Epinephrin.**

A *suprarenal gland derivative*, resembling *adrenaline*. The hydrate under the trade name of *adrin*, is employed in the same manner and in the same dosage as *suprarenin*, *suprarenaline* and other adrenal extractives as a *vaso-constrictor* and *hemostatic*.

### **Epinephrine Hydrate.**

(See *Adrin*.)

### **Ergot.**

*Spurred rye. Secale cornutum.*

Derived from diseased rye and contains *ergotic acid*, *ergotine* and several other agents.

J. G. Dorsey (p. c.) from a suggestion of Bartholow's Therapeutics, instils a *single undiluted drop of the fluid extract (alcoholic) into the eye two or three times a day*. The application is painful for a moment but is immediately followed by a sense of relief. He uses it in the *acute stages of both simple and purulent conjunctivitis* as an adjunct to other antiseptic treatment.

### **Escorcin.**

*Escorcinol. Aescorcin. C<sub>9</sub>H<sub>8</sub>O<sub>4</sub>.*

Derived from *esculetin* by *decomposition*.

This is a brown powder turned by alkalies to a green color, which changes to red. According to Frölich a *single drop of a 20 per cent. solution is the best test for corneal ulcers* and abrasions as the *red color of the alkaline escorcin solution* shows more plainly on the cornea than the green of fluorescin.

### **Eseridine.**

This miotic alkaloid is found associated with *eserine* in Calabar bean. Its formula is  $C_{15}H_{23}N_3O_3$  and it occurs as colorless crystals soluble in alcohol and ether. Its action resembles that of *eserine* but it is only one-sixth as powerful. There is also a *tartrate of eseridine*, a white powder soluble in water.

### **Eserine.**

*Physostigmine.*

This poisonous alkaloid, obtained from *Physostigma venenosum*,

or Calabar bean, is found in commerce as a white, crystalline, hygroscopic powder ( $C_{15}H_{21}N_3O_2$ ), and was introduced into ophthalmic surgery in 1870 by Laqueur. Exposed to air and sunlight it decomposes, turns red and should, consequently, be preserved in sealed glass tubes. Similar changes occur, more or less completely, in solutions of all its salts. The commonest of these are the sulphate (acid and neutral) hydrochloride, nitrate, borate, citrate and the salicylate, the first being generally preferred.

It has been pretty well demonstrated in late years that the old salts of eserine are practically of equal value to the new, and it is proved that eserine salts do not suffer in efficacy with the course of years.

Not only does eserine produce miosis as the result of contraction of the pupil sphincter but it causes a temporary spasm of the ciliary muscle, increasing the accommodative force and separating the punctum remotum from the punctum proximum. Its chief clinical use, however, is in the treatment of peripheral ulcer of the cornea and to reduce the intra-ocular tension, especially its abnormal rise, in *glaucoma*. Schmidt-Rimpler advises its use as a half per cent. solution from 2 to 6 times daily. As long as central vision does not decline and the visual fields show no diminution in size this local medication [or that by *pilocarpin* or *arecolin* (q. v.)] should be continued and no surgical procedure undertaken.

It is not yet clear how this reduction of tension is brought about, the commonly accepted explanation being that during the miosis the stretching of the iris permits of a readier exosmosis of the intra-ocular fluids.

American patients seem very susceptible to the irritation that follows the use of eserin and it cannot be used in the doses ( $\frac{1}{2}$  to 1 per cent.) generally prescribed by European writers. This difficulty may be avoided by giving the drug in smaller proportions as an oily solution or in the form of ointment. Another plan is to instil it in conjunction with cocain or after cocainizing the eye. This procedure not only relieves the pain but increases the miotic action of the drug. I have used for several years:

R

Cocain. mur.	gr. j
Eserin sulph.	gr. ss
Aquæ dest.	fld. ʒj.

The eye to be kept closed for 20 minutes after using.

Eserin lamellæ with cocain also act very nicely.

In addition to the employment of some form of cautery in spreading or deep ulcer of the cornea, deWecker believed that there was no

agent more prompt in affecting a cure than subconjunctival injections. Among other remedies, he recommending the following, fifteen drops of which should be injected *beneath the conjunctiva as near the ulcer as possible*:

R	
Hydrarg. bichlor.	0.015 (gr. $\frac{1}{4}$ ),
Eserine. salicylatis	0.05 (gr. i),
Aquæ dest.	100.00 (fl. $\bar{3}$ iiss).

I have not been able to verify the classic contention that eserine is superior to atropia in *peripheral corneal ulcer* and that the latter remedy should be preferred in central keratitis but it is mentioned here as taught by many authorities.

Schmidt-Rimpler gives the following prescription for the use of the salicylate:

R	
Eserin. salicylatis	0.05
Hydrarg. bichlor.	0.002
Sodii chlor.	0.01
Aquæ dest.	10.0

Sig: Poison.

It is well to remember that a drop of a one-tenth per cent. eserine solution in castor oil materially aids the recovery from the cycloplegia and mydriasis following the use of homatropine, mydrin and other drugs employed for the determination of the refractive condition.

## CHAPTER XXV.

### REMEDIAL AGENTS EMPLOYED IN THE LOCAL TREATMENT OF EYE DISEASES—CONTINUED.

*Eucaïne—Eucaïne Lactate—Eucapren—Eumydrin—Euphorin—Euphrasia—Euphthalmin—Europhen—Eusemin—Fennel—Fibrolysin—Fluorescein—Formaldehyde—Formalin—Formidine—Fowler's Solution—Gallanol—Gallicin—Gelatine—Glycerine—Glycerite of Tannin or Tannic Acid—Glycerite of Alum—Glycerite of Starch—Glycerite of Borax—Glycerite or Glyceride of Boric Acid—Glycerite of Hydrastis—Glycothymoline—Glycozone—Gold Carbolate—Gold Chloride—Gray Ointment—Gujasanol—Guthrie's Salve—Hamamelis—Hazeline—Hebra's Salve—Helleborein—Hemostatin—Hetol—Hodge's Mixture—Holocaine—Hematropine—Homoarecoline—Homococaine—Horst's Eyewater—Hydrastis.*

#### **Eucaïne.**

Chemically *allied to cocain* and used as a substitute for that anesthetic, was first recommended by Merling (47). There are two modifications of this agent, eucaïn “A and B”—now called “Alpha-eucaïn” and “Beta-eucaïn” respectively. Alpha-eucaïn is a synthetic derivative of triacetonamine; beta-eucaïn is derived from vinyl-diacetone-akalmine. Both are proprietary remedies and were issued by the same firm but the latter is the one now recommended as a cocain substitute under the trade name Beta-eucaïne hydrochloride or Eucaïne hydrochloride-B. The drug does not blanch the conjunctiva and its instillations are occasionally painful.

In 1 to 3 per cent. watery solution Beta-eucaïn does not produce mydriasis or paresis of accommodation, is not poisonous and is less liable to decomposition than cocain and can be boiled without decomposing. The *lactate* (q. v.) is by several ophthalmologists, including Darier (*Thérapeutique Oculaire*, p. 77), regarded as a desirable and efficient local anesthetic. It is much more soluble than eucaïne-B chloride and quite as stable. In eye surgery it is used in 2 to 15 per cent. solutions. It enters, with suprarenaline, into the composition of *Eucapren* (q. v.).

#### **Eucaïne, (Beta) Lactate.**

*Benzoylvinyldiacetoneakalmine lactate.*

White powder soluble in five parts of water, 9 of alcohol and 20



of glycerine. It is a valuable *local anesthetic* and owing to its greater solubility in water than *eucaine* (q. v.) is preferred to it in many mixtures. See *Eucapren*. Alone it is employed in from 2 to 15 per cent. solutions.

#### **Eucapren.**

Formerly called *Eucarenaline*.

This is a *combination of a one per cent. solution of Beta-eucaine lactate with 0.5 milligram. of suprarenalin per c.c.* It is marketed by Armour & Co., and used like *cocarenaline* (q. v.) and similar compounds as a *local anesthetic, hemostatic and blanching agent* in ophthalmic operations. I have used it and can speak confidently of its value.

#### **Eudrenine.**

The name given to a *concentrated solution of eucaine and adrenaline*. Each cc. contains eucaine 1-6 grain (0.01 gm.) and adrenalin 1-2000 grain (0.03 mgr.). One-half to 1 cc. is suitable for ordinary hypodermic dose. Diluted with four volumes of normal saline solution it forms a *solution suitable for local infiltration anesthesia*.

#### **Eugenol.**

*Eugenic acid.*  $C_{10}H_{12}O_2$ .

A colorless, oily liquid. Darkens on exposure. An oxidation product of oil of cloves with a strong clove odor. It is a powerful antiseptic and antiputrescent. While it reduces the sensibility of the conjunctiva and cornea it does not bring about complete anesthesia.

*Eugenol acetamide* is a crystalline, non-caustic antiseptic, like *eugenol*. It has a strong clovelike odor and has been recommended as a *local anesthetic*. It produces *considerable anesthesia of most mucous membranes* but there does not seem to be any reason why it should ever displace cocaine, eucaine or alypin in ophthalmic therapy.

#### **Eumydrin.**

*Atropine methyl nitrate. Methylatropine nitrate.*

A white, odorless crystalline salt resulting from the action of atropin on methyl nitrate. It melts at 160° C (325° F.) is readily soluble in water and alcohol; sparingly dissolved by ether.

This agent is employed as a *substitute* (although its action is distinctly weaker) *for atropia* on account of its non-toxic quality.

Goldberg (15) noticed that a one per cent. solution acts from five to eight minutes quicker than a 1-1000 solution of atropin, producing a dilatation of the pupil from 2.5 to 3 mm., and that its effect disappears toward the end of the second day, while the atropia mydriasis is still present on the fourth day. It acts more rapidly

and thoroughly than homatropia solution of the same strength and its effects last about twelve hours longer. As a ciliary and iridic parietic agent it ranks between atropia and homatropia. In pathologic conditions the effects of a one per cent. solution seem to be about the same as that of one per cent. atropia solution, but it is not so lasting. Moreover, the drug produced no increase of pressure or other untoward phenomenon either in the normal or diseased eye.

### **Euphorin.**

*Ethyl phenylcarbamate. Phenylurethane.*

A white, colorless, crystalline powder with a faint aromatic odor and an after-taste of cloves. It is sparingly soluble in water, more soluble in alcohol. It is an analgesic and antiseptic and is generally used in powder form or as an ointment.

Euphorin was recommended in 1890 by L. Sansoni\* as an antiseptic for the treatment of obstinate *corneal ulcers and chronic ophthalmia*, in the form of a powder, but this method of treatment appears to have passed into oblivion.

For the relief of the pain of *herpes zoster ophthalmicus* it has been prescribed as a *dusting powder* to be applied to the scabs or vesicles.

### **Euphrasia.**

*Eyebright. Eyewort. Euphrasy.*

The whole plant of *Euphrasia officinalis* is used in medicine, its active constituents being chiefly a *volatile oil* and *tannin*.

As both the botanical and vulgar names imply, Eyebright has from early times been employed (as a *lotion, compress* and *poultice*) to relieve *hyperemia and inflammation of the conjunctiva*.

### **Euphthalmin.**

Generally prescribed as hydrochloride, is a colorless, crystalline powder, very soluble in water and alcohol. It is a mandelic acid derivative of *beta-eucaine* (q. v.).

Two drops of a 5 per cent. solution produce complete dilation of the pupil, with very little effect upon the ciliary muscles, in about 60 minutes. This lasts about two hours with a return to the normal size in 24 hours.

For many years I have, at the suggestion of Jackson (30) used it combined in equal parts (two per cent.) with cocain for ophthalmoscopic examination. It produces in this combination the most satisfactory mydriasis, with the least annoyance to the patient, in from fifteen minutes to half an hour. Its employment is quite

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\**Therapeutische Monatshefte*, 1890, p. 452.

free of pain, vascular injection, rise of intraocular tension or corneal irritation. As mentioned before, the patient into whose eyes any cocain mixture is exhibited should keep them closed at least one-half the time until the ocular examination is made.

#### **Euophen.**

##### *Cresol iodide.*

Contains 27.6 per cent. of iodine. Light, yellowish, aromatic, amorphous powder. This proprietary agent is analogous to thymolis iodidum, U. S., and like it is occasionally used as a dusting powder in substance, or mixed with boric acid for the same purpose, in chancre of the lids, corneal ulcer, trachoma, etc. It may also be employed as an ointment (5 to 10 per cent.) with lanolin, lard, or other excipient in various forms of blepharitis. It has not the disagreeable odor of iodoform and for that reason is preferred by some in treating lid wounds and for other ophthalmic purposes.

#### **Eusemin.**

This is the trade name of a member of that numerous class—combinations of a local anesthetic with a suprarenal derivative. See *Eucapren*, *Codrenin*, etc. It is a mixture of 0.00075 per cent. of cocain with 0.0005 of adrenalin and recommended chiefly for *intracutaneous, hypodermic and subconjunctival injections*. Half a cc. suffices for *advancement* of a tendon; 1 to 2 cc. is enough for *enucleation*.

Ideler (*Therapeutische Monatshefte*, July, 1907), who has employed eusemine both by instillation and injection in one hundred minor operations on the eye, states that the results were almost always satisfactory.

#### **Euvaseline.**

This is the ordinary American vaseline of commerce to which *ceresin* (hard paraffin) (q. v.) has been added. It is supposed that in its application to the eye one obtains the double action of the vaseline as an aseptic application and a protective action from the admixture with ceresin.

#### **Fennel.**

The dried fruit of *Fœniculum vulgare* and other varieties yields from 2 to 5 per cent. of a camphoraceous, sweet-tasting, volatile oil to which the medicinal qualities of the plant are mainly due.

This plant furnishes a number of ophthalmic mixtures, most of them belonging to the home-treatment variety, and it is difficult to say what therapeutic value, if any, is to be attached to them. A weak tincture of the seeds enters into the composition of Romerhausen's eyewater (q. v.), and fennel water (aqua fœniculi) is a

frequent addition to European collyria for the relief of simple conjunctivitis and hyperemia of the lids. The latter preparation is used for this purpose abroad as much as rose or camphor water is prescribed in America.

### **Fibrolysin.**

A trade name for a sterilized solution of *thiosinamine* and *sodium salicylate*, containing 15 per cent. of the double salt. It is a colorless, aqueous solution and is interesting to us as a substitute for thiosinamine (q. v.). It is marketed by Merck in sealed, brown-glass vials to prevent decomposition. As it readily decomposes on exposure to the air the bottle contains one dose only (equal to 0.2 thiosinamine) to be given subcutaneously. It is claimed that fibrolysin is more effective, is more quickly absorbed and causes less pain and irritation than thiosinamin alone.

### **Fluorescein.**

*Resorcinolphthalein anhydride.*  $C_{20}H_{15}O_6$ .

Yellowish or yellowish-brown crystals obtained by fusing 7 parts of resorcin and 5 parts of phthalic anhydride. It is slightly soluble in water and ether; very soluble in alcohol with a yellow-green fluorescence. It forms variously colored solutions (so-called fluoresceids or fluoresceinates) with ammonia, liquor sodæ and liquor potassæ.

Whether used alone or in combination with potassium or sodium solutions, this *stain for corneal abrasions and ulcers* exhibits beautiful tints of yellow and green. Benson (26) in early tests with the salts concluded that when a cornea stains in whole or in part, the stained part represents either (1) an ulcer not yet covered with epithelium; or (2) an abrasion of epithelium; or (3) epithelium in a dead or diseased condition, though not necessarily in a dying state. The fact of staining is not therefore to be in all cases taken as an indication for active treatment (though this doctrine is often taught) for in many cases an ulcer which stains is nevertheless healing quite satisfactorily, and the fact of the epithelium taking on the stain is not necessarily an indication that an ulcer will certainly form.

After trials of the various preparations of fluorescein, I find that a 2 per cent. solution of potassic fluoresceide (potassium fluoresceinate, Merck), dropped on the cornea without the preliminary use of cocain and after subsequent gentle cleansing of the parts with sterile water, or a borated solution, forms the best method of employing this valuable reagent. The test is further robbed of its objections if the patient closes his eyes for a few minutes after the instillation and all superfluous stain be then washed off by flooding the eye with sterile water.

I prefer the following formula (54) :

℞	
Fluorescein.	gr. viii (grm. 1.1)
Liq. potassæ	f̄ss (grm. 2.0)
Aquæ dest.	f̄ji (30.00)

Allow this to stand for ten days in a cool dark place and then filter. For diagnostic purposes instill a single drop into the conjunctival sac or allow it to fall on the cornea. Close the eye for two minutes. Gently irrigate the globe and sac with warm normal salt solution or a 2 per cent. boric acid mixture. The stain is a bright yellow-green which accurately maps out the disturbed area and does not irritate the most sensitive eye.

*Uranine*, the sodium salt of fluorescein, very soluble in alcohol and water, may be used like the potassium compound but, in my judgment, it is not so satisfactory. It is a yellow-brown powder and interesting because of its use as a *test of death*. If 15 grains (1 grm.), dissolved in water, be injected into the human body the scleræ will be stained green within an hour, if life still exists.

#### Formaldehyde.

*Formic aldehyde. Methyl aldehyde. HCHO.*

Made by the partial oxidation of methyl alcohol. Its solutions should be kept cool, in well stoppered bottles, and away from the light. At ordinary temperatures formic aldehyde is a colorless gas with a pungent, irritating odor. Fifty per cent. solutions in water are obtainable, but at that strength the solution decomposes; hence the use of a weaker solution for surgical purposes.

Formaldehyde is *incompatible with* alkaline preparations, tannin, gelatine, and the salts of silver and copper.

Valude was the first to bring this valuable remedy to our notice as an antiseptic for ophthalmic use. In its pure form it proved very irritating, producing burning, smarting and lachrymation when used in 1:1000 or 1:2000 solutions for conjunctivitis. More recently we have come to rely upon its 40 per cent. solution under the commercial title of *formalin* (q. v.), in which state it has proved a most valuable germicide and substitute for corrosive sublimate. Formaldehyd in its gaseous form is used as a disinfectant for ophthalmic instruments, special disinfectant apparatus having been devised for this purpose.

#### Formalin.

*Formol. Liquor formaldehydi, U. S. Solution of formaldehyde.*

The official solution, a colorless liquid with a burning taste and

pungent odor, has an irritant effect upon the skin and mucous membranes. It mixes in all proportions with water and alcohol.

This is a 37 to 40 per cent. watery solution of the gaseous formaldehyd ( $\text{CH}_2\text{O}$ ) and is one of the best ocular antiseptics we possess. It lessens secretion in almost all forms of conjunctival infection and for this particular purpose is employed in about the same proportion as corrosive sublimate. It is just as efficacious as that salt without possessing its irritant and poisonous qualities. As it does not form insoluble compounds with the tissues and is not incompatible with most of the remedies used in ophthalmic practice it is much to be preferred to bichloride of mercury. I have used it for years as a germicide and am much pleased with it. I use it in collyria either alone or in conjunction with other remedies, in the proportion of 1-10,000 to 5,000. I have also found it excellent as a preservative of alkaloidal solutions in the 1-10,000 strength and believe it can be used, without damage to them, as strong as 1-100 for the preparation of instruments for operation.

H. McL. Morton uses formalin, *one part to 80* as a direct application to *corneal ulcers*, and finds it more useful than the majority of applications he has employed.

E. C. Boyd (p. c.) prefers as a *simple collyrium one drop* of formalin in *four fluid ounces of distilled water* to be used in an *eye-cup* several times a day.

#### **Formidine.**

*Methylene disalicylic acid iodide.*  $\text{C}_{15}\text{H}_{10}\text{O}_6\text{I}_2$ .

It is a reddish-yellow powder, nearly odorless and tasteless; contains about 46 per cent. of iodine and is marketed by Parke, Davis & Co. as a *substitute for iodoform*. It seems to me admirably adapted for use as a dusting powder in lid wounds, operative and other. It is found in sprinkler-top bottles.

#### **Fowler's Solution.**

*Liquor potassii arsenitis.* Solution of potassium arsenite.

About one per cent. of arsenic trioxide, two per cent. of potassium bicarbonate and three per cent. of compound tincture of lavender enter into this preparation.

Arsenical compounds are rarely applied directly to the eye, but in the treatment for *trachoma* J. G. Dorsey (p. c.) uses a mixture containing Fowler's solution in a combination which is given elsewhere. See *Trachoma*.

#### **Gallanol.**

*Gallic acid anilide.* *Gallinol.* *Gallanilide.*

A brownish, crystalline powder, slightly soluble in water; more



so in ether and alcohol. Experiments have been made with this substance in eye diseases as 5 to 20 per cent. ointments or as a dusting powder with talc, but the outcome has not been satisfactory.

#### Gallicin.

*Methyl gallate.*  $C_6H_2COOCH_3$ .

This proprietary remedy, said to be gallic-acid-methyl-ester (Merck), is a dirty-white crystalline substance made by heating a methylated solution of gallic acid with sulphuric acid.

Its use in ocular therapy is as a dusting powder in many external diseases of the eye, such as the various forms of chronic and sub-acute conjunctivitis or it may be applied with a camel's-hair pencil to phlyctenules or in superficial ulcer of the cornea.

This is the method advised by me\* a number of years ago, but I would strongly urge the instillation of a couple of drops of holocain (1-5 per cent.) before applying the powder, because it is likely to irritate and cause pain.

#### Gelatine.

Obtained from the hoofs, horns, bones, etc., of certain animals. It is soluble in boiling water, glycerin and acetic acid, but insoluble in alcohol, ether or cold water. It gradually swells up in the cold water, forming a soft, viscid mass that absorbs from 5 to 10 times its weight of the fluid.

This agent is employed occasionally in the dispensing of ointments and as such is generally mixed with such agents as are not incompatible with the water added to soften it. Such a preparation is Michel's ichthyol ointment (q. v.).

It is a good menstruum for the exhibition of certain alkaloids used in ophthalmic surgery and for this purpose we have a large number of official and proprietary *discs* or *lamellæ*, elsewhere described in this volume. For medicinal purposes the commercial product should be dissolved in hot water, filtered, treated with alcohol and dried. It is then a colorless, odorless substance occurring in thin, crackly, transparent sheets, bearing the impression of the netting upon which it has been dried.

#### Gelseminine.

(Not *Gelsemine*.) *Gelseminina.*  $C_{22}H_{26}N_2O_3$ .

Alkaloid (Merck) from the root of *Gelsemium nitidum vel sempervirens*. It occurs in minute yellowish-white crystals, odorless but with a bitter taste; very poisonous; slightly soluble in water, very soluble in ether and alcohol. The *hydrochloride*, as white, granular crystals, is freely soluble in water.

\*Hare's *System of Practical Therapeutics*. III. 1901.

The alkaloid and its salt act as *mydriatics* and are used for dilating the pupil in 1 to 500 solutions; the latter may also be had in the form of gelatine disks, gr. 1-500.

### **Glycerine.**

*Glycerol.*  $C_3H_5(OH)_3$ . *Trihydric alcohol.*

A colorless, viscid, sweet, soluble liquid found in fats and fixed oils (4-7 per cent.) in combination with the fatty acids, as compound ethers. It is mostly obtained as a by-product in the manufacture of soap. Glycerine is very hygroscopic and mixes in all proportions with water and alcohol.

Glycerine is used as a solvent of or in chemical combination with other agents to form compounds known as (*glycerita, glycerina*) glycerols, glycerides, glycerites or glycerins (B. P.), quite a number of which are used in ocular diseases. In addition to this employment of the remedy it is sometimes added to ointments, or even directly applied, in full strength or diluted with half its bulk of water, to the conjunctiva where it acts as a mild stimulant, antiseptic (?) and protective. After penciling with blue stone, *lapis divinus* or silver nitrate it may be applied with a brush to limit the caustic action of the drug. It is an admirable excipient for *copper sulphate in trachoma* (q. v.) and may be used in saturated solution or diluted with water to the extent desired. It also dissolves iodine, phenol and other ocular remedies, making with them solutions that are readily applicable to the eye structures.

### **Glycerite of Tannin or Tannic Acid.**

*Glycerin of tannin.*

This compound contains 20 per cent. of tannin and 80 per cent. of glycerin and forms a brownish solution that can be conveniently applied as an astringent in those ocular conditions (trachoma, follicular conjunctivitis) in which tannic acid (q. v.) is useful.

### **Glycerite of Alum.**

*Glycerin of alum.*

This is a convenient preparation containing about one part of alum dissolved in eight parts of glycerin. Its ocular uses are the same as alum.

### **Glycerite of Starch.**

*Glycamyl. Plasma. Glycerin of starch.*

A homogeneous, neutral, jelly-like mass containing 10 per cent. each of starch and glycerine with 80 per cent. of water. It is an emollient application useful in burns of the face and eyelids, may be used to remove iodine stains and has been employed as a medium for other applications to the external eye.

### Glycerite of Borax.

#### *Glycerin of borax.*

Contains one part of borax with six of glycerin. Diluted with a varying quantity of water this mixture, that always has a little free boric acid, is used by some ophthalmologists as a collyrium.

### Glycerite or Glyceride of Boric Acid.

(See *Boroglycerin*.)

### Glycerite of Hydrastis.

This is an official mixture intended to furnish a fluid preparation of hydrastis (q. v., miscible with water in all proportions. Each cc represents 1 grm. of hydrastis or 463 grains to the fluid ounce.

### Glycothymoline.

A proprietary article employed in catarrhal conditions of mucous membranes. It is occasionally used in ocular therapy and is said to contain *potassium carbonate, sodium benzoate, sodium borate, smaller portions of sodium salicylate, thymol, menthol, glycerin and alcohol, colored with cochineal.*

R. L. Randolph (p. c.) usually treats cases of *dacryocystitis* by irrigation and the solution which he has found most useful is glycothymoline (Kress) *commencing with equal parts of water and glycothymoline* and finally irrigating regularly with the undiluted preparation.

H. McI. Morton (p. c.) finds the following collyrium when used in an *eye-cup* of especial advantage in many forms of simple conjunctivitis:

R

Acid. boric.	gr. 300
Sodii borat.	gr. 200
Hydrarg. chlor. corros	gr. 1-12
Glycothymol.	fl. ʒi
Aquæ dest. ad.	fl. ʒxii

### Glycozone.

A proprietary liquid agent said by the maker, Marchand, to be a stable chemical compound resulting from the action of ozone on pure glycerin. It has a pleasant, sweetish-acid taste and may be used for much the same purposes that the official hydrogen dioxide water is employed.

### Gold Carbolate.

The only reference I can find to the use of this agent in eye surgery is its employment in the form of a *one per cent. solution in corneal ulcer*. Galezowski has applied it in this strength as a *cautery* instead of lactic acid (q. v.) and similar germicides.

**Gold Chloride.**

*Auric chloride. Gold trichloride.*  $\text{Au Cl}_3 + \text{HCl} + \text{HH}_2\text{O}$ .

Yellow crystals, soluble in water and alcohol. Contains about 49 per cent. of pure gold.

The great expense and untried characters of gold salts make it unlikely that any of them will ever be used to any extent in ophthalmic practice. However, a report of Verhoeff (*Journal American Medical Association*, 1906) is worth a short notice.

By dissolving 1 grm. (gr. 15) of chloride of gold in 50 cc. (f. oz. 1 2-3) of water, and adding enough 5 per cent. aqueous caustic soda solution to make the reaction faintly alkaline, a fluid is obtained of very *powerful bactericidal action*; it is used as a *collyrium* with 50 cc. (f. oz. 1 2-3) of normal saline solution and 100 cc. (f. oz. 3 1-3) of a 1 per cent. solution of boric acid. This gold solution possesses great *antiseptic and antifermentative power*, and is said to possess the great additional advantage of being *without irritant action on the conjunctiva*. Again, no constitutional disturbance occurs as the result of introducing the proper quantity of the salt into the conjunctival sac. See, also, *Auri et sodii chloridum*.

**Gomenol.**

*Niaouli oil.*

A volatile oil extracted from the leaves of *Melaleuca viridiflora*. It contains cineol, terpineol and traces of acetic, butyric and valeric acids.

Ambialet (*Annales d' Oculistique*, December, 1907) has found it useful as a *local application* in a very chronic case of *leutic interstitial keratitis*. Vision was improved, after five months' treatment with this agent alone, from light perception to one-third of normal.

**Gray Ointment.**

*Mercurial ointment.* (See *Mercury, Ointment of.*)

**Gujasanol.**

*Diethylglycocolguaiacol hydrochloride.*

Occurs as colorless crystals with a faint odor of guaiacol. It is very soluble in water; slightly in alcohol.

It is a mild *antiseptic* and used as such in *simple acute and chronic conjunctivitis*, in from 5 to 20 per cent. solutions three or four times daily.

**Guthrie's Salve.**

The formula of this silver ointment is given by Graefe (59) as:

R

Pulv. argent. nit.	0.2 gm. (gr. iii)
Liq. plumbi acet.	0.25 cc. (m 3)
Vaselin. alb.	4.0 gm. (3j)

In old samples of this salve *silver acetate* in small quantity will probably be found associated with excess of nitrate. Essentially, the active remedies in the ointment are the two silver salts.

### Hamamelis.

*Witchhazel. Winter bloom. Striped alder.*

The dried leaves and bark, collected in the autumn of *Hamamelis virginiana*. They contain tannic and gallic acids and are sedative and astringent. A decoction of the watery as well as of the alcoholic extract and the tincture are the best known preparations.

Whether there are distinct virtues in any of the preparations of "witch hazel" apart from the alcohol and other adjuvants that are commonly prescribed with it, I cannot say, but that a number of experienced surgeons *prescribe it in collyria, washes and fomentations*, to the eye in hyperemia and simple infections of the conjunctiva, I am well aware. For instance, J. L. Dickey (p. c.) has had much satisfaction from the following formula:

R

Cocain. hydrochlor.	gr. v
Acid. boric.	gr. x
Tinct. hamamelidis.	
Aquæ dest.	āā fl. ʒss.

To be instilled every three or four hours.

I believe the above would be a safer prescription if the cocaine were omitted, its dose reduced to half a grain, or alypin or beta eucaine substituted for it.

T. W. Moore (p. c.) often prescribes the following formula in inflammatory conditions of the conjunctiva, whether the increased secretion be purulent or not:

R

Aquæ hamamelidis.	10.00
Cocainæ hydrochlor.	0.20
Sodii chlor.	0.65
Aquæ rosæ ad.	30.00

Three drops in each eye three times daily. To this he sometimes adds solution (1:1000) adrenalin chlor. 4.00 c.c.

### Hazeline.

(See also *Hamamelis*.)

I have had little or no experience with this proprietary remedy—an *extract of hamamelis*—but Lawson (*Text-book*, p. 538) advises it as a soothing collyrium in the following formula:

R

"Hazeline"	gr. xv-xx
Aquæ dest.	fl. ʒi

**Hebra's Salve.**

(See *Diachylon*.)

**Helleborein.**

Glucoside from *Helleborus niger*,  $C_{37}H_{56}O_8$ .

This poisonous agent is a yellowish powder, soluble in water and alcohol. It is said that 3 or 4 drops of a solution containing in each drop 1-125 gr. (0.0005 grm.) will produce *complete anesthesia*, without irritation, of the cornea, lasting half an hour.

**Hemisine.**

The trade name for an effective, non-irritating *adrenaline* substitute, described by the proprietors (Burroughs, Wellcome & Co.) as "a derivative of the suprrenal gland, put up in ophthalmic tabloids each of which contains approximately one-hundredth of a grain. A tabloid dissolved in ten minims of water furnishes an active 1:1000 solution."

**Hemostatin.**

So far as I can discover this agent presents no practical advantage over suprarenalin or adrenalin. It is generally used in 1-1,000 solution and closely resembles in action the suprarenal capsule derivatives elsewhere discussed.

**Hetol.**

*Sodic cinnamate. Sodium cinnamylate.*  $NaC_9H_7O_2$ .

This is a white, crystalline powder readily soluble in water. It is mostly employed in eye diseases by sub-conjunctival injection, the eye being first cocainized. Half a gram of a 1 per cent. solution is at first injected every other day and then daily. More or less pain is the result, followed by a feeling of comfort. A number of observers have testified to its value in interstitial keratitis, corneal ulcer, herpes ophthalmicus, episcleritis and in the various forms of uveitis, but I cannot report upon it from personal observation.

Both Pflueger and Cohn observed much benefit from the use of this remedy in *parenchymatous keratitis*. The latter used it in the form of collyrium—a one per cent. solution—to which he added the same quantity of cocaine to minimize the pain. He believed that it exerted a favorable effect on the disease both in its acute and chronic phases.

**Hodge's Mixture.**

(See *Silver iodide*.)

**Holocaine.**

*Holocaine hydrochloride. Amidin.*

This derivative of phenacetin is a colorless, odorless, neutral crystalline powder, having a slightly bitter taste. It is soluble in 40 parts of water.



It is four times as anesthetic as cocain; it is non-toxic and does not affect the cornea, pupil or ciliary body. However, its instillations produce more hyperemia of the conjunctiva and more local irritation than cocaine. On account of its irritant quality I have been in the habit of using it in conjunction with cocaine and believe that the fullest anesthetic effects can be had from the instillation, every two minutes for ten minutes, of a single drop of the following mixture. My confreres in St. Luke's and Wesley Hospitals have used it for several years with the best results. The patient keeps the anesthetized eye closed before and after the operation for which it is instilled:

R

Cocain. hydrochlor.	gr. j.
Holocain. hydrochlor.	gr. $\frac{1}{4}$
Aquæ dest.	fld. $\bar{5}$ jj.

To be freshly prepared.

On boiling in glass vessels the *aqueous solution becomes turbid* owing to a separation of a small quantity of the free base by alkali derived from the glass. It should form a clear, colorless solution in water, neutral or faintly alkaline, yielding precipitates on addition of silver nitrate or ammonia. The base obtained by precipitation with monia and crystallized from alcohol forms colorless needles which melt at 121 degree C. (249 degrees F.) Incinerated on platinum it leaves no residue.

It is incompatible with alkalies and the usual alkaloidal reagents. *Glass vessels should be avoided in preparing and preserving the solution, porcelain being used instead.*

R. L. Randolph sees a great many cases of foreign body in the corneae of railroad men from the shops. Generally the foreign substance is either a particle of rust or a minute piece of emery. When he sees the patient the foreign body has generally been picked at and an *infected ulcer* is present. When every trace of the extraneous substance has been removed he finds this collyrium most soothing and antiseptic:

R

Holocain.	gr. ss
Sod. chlor.	gr. iii
Aquæ dest.	$\bar{5}$ ii

A small quantity is given for healing usually takes place in from 24 to 48 hours.

#### Homatropine.

$C_{10}H_{21}NO_3$ . *Oxytoluoltropine*.

Homatropine hydrobromide (or hydrobromate) is the commonest

salt of this alkaloid, although the hydrochloride and sulphate form, like it, regular, white crystals. The first named seems best adapted for clinical purposes. It is soluble in 10 parts of water, the solution being permanent. The alkaloid forms regular, limpid crystals. It is slightly poisonous and dilates the pupil and paralyzes the ciliary muscle almost as energetically as atropine.

This mydriatic agent is chemically a mandelic ether of tropin. It was discovered by Ladenburg, of Kiel, and its clinical value in ophthalmology lies in its use as a cycloplegic substitute for atropia and scopolamin, since the fullest paresis of accommodation produced by it passes off in twenty-four hours. In the experiments which I, in 1890, originally made were with this agent I found that the best results are obtained from discs of homatropine (alkaloid) and cocain (alkaloid), containing gr. 1-50 each. One of these is placed, from the tip of a moistened camel's-hair brush, on the eyeball three or four mm. from the superior limbus (while the patient looks down and the upper lid is raised by drawing the eyebrow upward) every twenty minutes for an hour. These three disks, the eye meantime being left closed, set up very little irritation and produce the most complete cycloplegia in an hour and a half after the introduction of the first disk. If the pupils are not normal on the next day a drop of a half per cent. solution of eserin sulphate in castor oil will soon contract them.

The aqueous solution, commonly employed in the form of the hydrobromide, is used in about 2 per cent. strength as a mydriatic and (sometimes) in greater strength as a cycloplegic; a drop of 1-500 strength instilled into the conjunctival sac every five minutes, five times, will produce a maximum dilatation of the pupil in three-quarters of an hour, returning to normal in 14 to 18 hours. Other soluble salts of homatropine also used in ocular therapy in the same dosage are the sulphate, salicylate and methylbromide.

Cocain increases the effect of this drug and is used for that purpose in solution just as in gelatin discs.

An effective formula is:

R

Homatropin. hydrobromi.

Cocain. hydrobrom. aut hydrochlor.

āā gr. jv.

Aquæ dest.

flid. ʒiv.

The patient to keep the eyes closed one-half the time until the examination. It must be remembered that homatropin and its salts are very expensive agents and should be prescribed with due regard to economy.

According to Jackson, strong solutions (4 to 5 per cent.) induce a burning sensation in the conjunctiva of five minutes duration without causing marked hyperemia. On the other hand, even weaker solutions may after 3 to 10 minutes induce a marked congestion of the vascular zone about the cornea; also of the vessels of the sclera, the same as after the instillation of atropine. After instillations of large doses of homatropine, its bitter taste becomes perceptible, but not the dryness of the pharynx which follows the use of atropine.

#### **Homoarecoline.**

*Arecaidinethyl ester.*

A colorless liquid, soluble in water and alcohol; less toxic than *arecoline* (q. v.) but possessing similar *miotic powers*.

#### **Homococaine.**

*Ethyl-benzoyl-cocaine. Coca-ethylene.*

This crystalline substance, a by-product in the manufacture of cocaine by synthesis, forms salts which have an anesthetic action, but much weaker than that of cocaine.

#### **Homorenon.**

*Ethylaminoacetobrenzcatechin hydrochloride. Ethylaminoketone.*

A derivative of suprarenin synthetic (q. v.). It is a stable product appearing as a small crystalline substance, very soluble in water.

A 4 to 5 per cent. solution corresponds in efficiency to a 1 to 1,000 solution of suprarenin synthetic, or the product obtained from the adrenal gland. It is more easily employed than suprarenin synthetic, as the quantity needed for making solutions can be accurately weighed, and solutions therefore extemporaneously made.

#### **Horst's Eyewater.**

*Collyrium astringens luteum.*

According to the Austrian pharmacopeia this collyrium, recommended by Fuchs, especially in chronic catarrh of the conjunctiva, and frequently prescribed abroad, is made in the following manner: Take ammonium chloride, 50 centigrammes and zinc sulphate 125 centigrammes. Dissolve them in 200 grammes of distilled water and add a solution of 40 centigrammes of camphor in 20 grammes of dilute alcohol and 100 centigrammes of saffron. Digest for 24 hours with frequent agitation and filter. This collyrium is generally mixed with an equal quantity of water for use in conjunctival catarrh.

#### **Hydrastis.**

*Golden seal. Yellow root. Indian dye.*

These and many more are the popular synonyms for *Hydrastis Canadensis*, a small shrub whose yellowish rhizome yields 2 to 3 per

cent. of the alkaoid *hydrastin*, 4 per cent. of *berberine* (q. v.) and some *canadine*. The first is probably the active principle of the tincture, glycerite and fluid extract used in the eye. The best form, however, is *hydrastin sulphate*. Hydrastin occurs as white or colorless, odorless, tasteless prismatic crystals, although its salts generally have a bitter taste. It is sparingly soluble in water. It forms several salts, of which the chloride and sulphate are best known, the former, official in the U. S. P., being formed artificially. The sulphate is decidedly hygroscopic, has a bitterish taste, and like the chloride is very soluble in water. All the preparations of hydrastin are poisonous.

The *Extra Pharmacopeia* says that purulent ophthalmia neonatorum is occasionally treated by *one per cent. hydrastin solution containing one-tenth of one per cent. morphin sulphate*.

G. E. Dean (p. c.) uses the following collyrium in subacute *conjunctivitis* and in other diseases of the conjunctiva with profuse and purulent discharge:

R

Fluid ext. hydrastis, U. S.	m. iv
Glycerini	m. xl
Aquæ dest, ad	fl. ʒi

J. W. Wright (p. c.) uses this drug with considerable satisfaction in the *catarrhal forms of conjunctivitis*. He prefers the agent known as the sulphate of berberine (q. v.), using as a solvent water and glycerine. He much prefers the yellowish crystal to the colorless form and gives the following formula, from which, in my judgment, the cocaine should be excluded:

R

Hydrastin.	gr. ss
Acid. carbolic.	gtt. i
Morphiæ sulph.	
Cocain. mur. āā	gr. iv
Glycerini	fl. ʒii
Aquæ dest.	fl. ʒvi

Mix and filter. A few drops in the eye three or four times a day.

Following the example set by genito-urinary surgeons in the successful treatment of urethral gonorrhea by this remedy, it has been prescribed for local use in gonococcus ophthalmia. The best known formula is F. X. Scott's mixture:

R

Hydrastin sulphat.
Acid boracic.

Sod. boratis, āā	0.3 gm. (gr. v)
Tinct. opii deodor.	2.0 c.c. (f5ss)
Aquæ dest.	30.0 c.c. (f5j)

Filter.

Sig: To be instilled every hour.

I have found this prescription quite as effective without the opium, and have used it with considerable success in other forms of ocular blennorrhea.

# CHAPTER XXVI.

## REMEDIAL AGENTS EMPLOYED IN THE LOCAL TREATMENT OF EYE DISEASES—Continued.

*Hydrogen Peroxide—Hydroquinone—Hydrozone—Hyoscine—Hyoscyamine—Hyoscyamus Niger—Ichthargan—Ichthyol—Iodine—Iodine Trichloride—Iodine-vasogen—Iodized Glycerol—Iodoform—Iodol—Iodoformogen—Iodopin—Isophysostigmine Sulphate—Itrol—Jaborandi—Jequiritol—Jequirity—Kummerfield's Lotion—Labarraque's Solution—Lactic Acid—Lanolin—Lapis Divinus—Lard—Largin—Lead Acetate—Lead Water—Lemon Juice—Lenicet—Lime Chlorinated—Lime Permanganate—Lime Water—Liquor Potassae Arsenitis—Loretin—Lotio Nigra—Lysol—Magnesia, Calcined—Magnesium Sulphate—Mercurial Ointment—Mercurial Preparations.*

### Hydrogen Peroxide.

*Hydrogen dioxide.  $H_2O_2$ . Dioxygen.*

The official liquid we familiarly call by this name is the *Aqua hydrogenii dioxidii*, U. S. P., and is a slightly aqueous solution of hydrogen dioxide, containing when freshly prepared about 3 per cent. by weight or 10 volumes of pure dioxide of hydrogen. It should be kept in a cool place and when uncorked the gas should escape with but slight pressure. Solution of the peroxide is a colorless, odorless liquid with a slightly acidulous taste. It decomposes readily into oxygen and water. It has powerful bleaching, disinfectant and oxidizing powers, foaming up and disengaging active oxygen or ozone during the process. In ocular therapy it is used as a disinfectant and cleansing agent in the treatment of wounds of the lids, especially after operations on the skin surface, as an application to corneal ulcer, in purulent conjunctivitis, dacryocystitis, etc. A proprietary solution of hydrogen peroxide, sold under the name *dioxogen* and said to contain 3 per cent. of  $H_2O_2$ , is much advertised in the lay press, a fact that should be considered by physicians in ordering these preparations.

One obstacle that has until recently stood in the way of the general use of hydrogen peroxide has been the unstable nature of the product, as well as the fact that the ordinary commercial varieties are seldom, if ever, free from acid. Merck has overcome these drawbacks by the introduction of 30 per cent. "Perhydrol" (q. v.)—that is to say, an absolutely pure and acid-free hydrogen peroxide, not subject to spontaneous explosion, and capable of being kept almost in-



definitely in the original bottles, which are lined with *ceresite*. (*Ophthalmoscope*, August, 1908, p. 610.)

*Solutions of hydrogen peroxide are incompatible with alkalis, albuminous compounds, carbolic acid, glycerine, hydrocyanic acid, iodides, permanganates and several other salts used in ophthalmic practice.*

It may be used in its pure state or diluted with distilled water. See also *glycozone, dioxygen, hydrozone, perhydrol* and *acetozone*.

A. Jacqueau<sup>1</sup> has, in *various corneal affections*, used with advantage a solution containing 1.8 p. c. by weight = 6 p. c. by volume. He used this every day as a lotion or by instillation, and had satisfactory results, even in severe cases of keratitis. With this treatment combined with cauterization and evacuation of pus from the anterior chamber he obtained a complete cure within a month of traumatic corneal ulcers with hypopyon. In a case of corneal abscess the pain was relieved by the unaided use of *perhydrol* solution, and the pus soon disappeared. In perforating corneal ulcer the remedy also promptly assisted healing and cicatrization.

#### Hydroquinone.

*Quinol. Hydrochimone. Paradioxybenzene.*  $C_6H_6O_2$ .

Made from quinone by reduction with sulphurous acid. Colorless crystals soluble in 17 parts of water; more soluble in alcohol and ether. It is decidedly *antiseptic* and is used in *one to three per cent. solutions* in all forms of *conjunctivitis* with much discharge. Solutions should be *freshly made* as old ones have an irritant, caustic action.

#### Hydrozone.

This proprietary solution is intended to be a substitute for the U. S. *aqua hydrogenii dioxide*, which see. Although it is 3 times as strong as the official solution it loses very little of its hydrogen peroxide under ordinary conditions and may, therefore, be regarded as a fairly stable and useful preparation.

#### Hyoscine.

*Scopolamine.*

This alkaloid is obtained not only from *hyoscyamus* but many other plants of the *Solanaceæ*. Its best known salt is the hydrobromide which is official in the U. S. P. It occurs in rather large, colorless, transparent crystals that are odorless but have a bitter, acrid taste. It is soluble in 4 parts of water and 16 parts of alcohol.

When pure this drug is identical with scopolamin. Schmidt showed that chemically pure hyoscin produces physiological effects different from commercial hyoscin and that these differences are due to

<sup>1</sup>*Semaine médicale*, 1907, No. 8, p. 94.

the presence in the latter of a left-turning hyoscin called atropin. He it was who called the chemically pure product scopolamin. In the market we find two salts, scopolamin hydrobromide (Merck.  $C_{17}H_{21}NO_4 \cdot HBr + H_2O$ ) in tablet-shaped, transparent, soluble crystals and scopolamin hydrochloride (Rählmann,  $C_{17}H_{23}NO_3 \cdot HCl$  3). Owing to the greater dilution of these salts in clinical use they do not so often produce irritative conjunctivitis and, it is claimed, much less increase of intraocular tension than atropia.

This drug is quite five times as powerful as atropia sulphate. The duration of the pupil dilation is about five days. It is believed (and I have reason to concur in this belief) that it does not irritate mucous membranes as readily as atropia and is consequently indicated in persons exhibiting an idiosyncrasy against that drug. Owing to its brief and complete cycloplegia it is much preferred by some ophthalmologists as a routine agent for measuring refractive errors, in which case a solution of 1:500 generally suffices. At the same time it is a most powerful poison and its use should be carefully watched by the surgeon. The strength for home use in iritis, corneal ulcer, etc., is 1:1000.

In the literature of scopolamine and hyoscin and their salts it must be remembered that one is probably discussing identical therapeutic agents. Merck's "Index" mentions, in addition to the hydrobromide, the crystalline hydriodide, hydrochloride and the sulphate with the same actions and uses as hyoscin. The same authority also lists scopolamine hydriodide, hydrobromide, hydrochloride, methylbromide and sulphate, but states them to be identical in all respects with the corresponding hyoscin salts.

Adams uses a single drop in each eye of a *one-half of one per cent. solution* and considers the eye ready for refraction in one hour afterwards. The accommodation recovers in about three days. He regards the drug as thoroughly reliable and finds it seldom necessary to use a second drop.

### Hyoscyamine.

This alkaloid occurs not only in *Hyoscyamus niger* (q. v.) but in belladonna, stramonium and several other *Solanaceæ*. It is an isomer of atropine into which it is easily converted. Hyoscyamine crystallizes in colorless, odorless, slender, silky, anhydrous needles that have a disagreeable, acrid taste. It is slightly soluble in water, more so in alcohol, chloroform and ether. The official salts are the hydrobromide and the sulphate, both of which are to be preferred in ophthalmic practice to the basic alkaloid, owing to their ready solution in water, oil and other menstrua, and because they are more easily absorbed by the

tissues. As they are decomposed by light and moisture they should all be kept in amber-colored or "actinic," glass-stoppered bottles.

The action of these drugs is similar to that of atropine, although the mydriasis does not last as long in the case of hyoscyamine and the local irritation is likely to be greater. It is prescribed in from one-half to one per cent. solution. Merck's "Index" lists, besides the alkaloid and the U. S. P. salts, the hydriodide, the hydrochloride and the methyl bromide, as well as pseudo-hyoscyamine, and several amorphous salts.

Alexander Randall (p. c.) prefers *hyoscyamine* (2 grains to the fluid ounce) as a *cycloplegic*. He has found it prompt and vigorous, holding the ciliary muscle firmly in its grasp for 72 hours, meantime giving complete, enforced rest. The cycloplegic effects practically disappear in 150 hours after the initial instillation.

### Hyoscyamus Niger.

*Henbane. Stinking nightshade. Poison tobacco.*

The flowering tops and dried leaves yield 0.08 per cent. of mydriatic alkaloids.

This poisonous member of the *Solanaceæ* furnishes us with hyoscin or scopolamin and hyoscyamin (q. v.), two of the most powerful and active of the cycloplegics. The extract is occasionally used as a collyrium:

R

Ext. hyoscyami	0.05 grm. (gr. 7-10)
Aquæ dest.	10.0 (℥iiss)

It is one of the ingredients of the *aqua nigra* (q. v.) of von Graefe, who was also fond of using the extract of hyoscyamus as an ointment to the forehead and temples in painful diseases of the eyes.

### Ichthargan.

*Silver Ichthyolate. Soluble silver sulphichthyolate.*

A compound of ichthyol and silver said to contain 30 per cent. of the metal and 15 per cent. of sulphur in organic combination. This agent is a brown, amorphous, stable powder with a chocolate-like odor, readily soluble in water, diluted alcohol and glycerin. It is affected by light and is incompatible with the soluble chlorides. For this drug the claim is made that, containing more silver than the other organic silver compounds lately introduced, it has a prior claim to our consideration in prescribing argentic remedies for purulent conjunctivitis, trachoma, etc.—especially where a non-irritating substitute for silver nitrate is desired.

### Ichthyol.

*Ammonium ichthyolsulphonate. Desichtol. Ammonium Ichthyol. Ammonium ichthyolate.*

The source of this valuable remedy is a crude fish-oil obtained

from fossil rocks in the Tyrol. It is a transparent, yellow-brown liquid with a peculiar, fishy odor. What we know as "ichthyol" is a syrupy, reddish-brown, transparent liquid of a bituminous odor and taste, soluble in water and glycerin and made by the action of ammonia on an ichthyol derivative. In the same way we have a *sodium-zinc-and calcium ichthyol*. Deodorized ichthyol is known by the trade name of "Desichtol."

Were it not for its disagreeable odor and dark color this compound would be more generally employed in blepharitis and allied diseases. I have frequently employed it with success as one per cent. mixtures with lanolin, cold cream and petrolatum. Von Schlen (56) advises the following formula in *blepharitis eczematosa*:

℞	
Ichthyol.	0.03 gm. (gr. ½)
Amyli, zinci ox. āā	10.0 gm. (3iiss)
Vaselini	25.0 (5vi, gr. xxv)

Another formula by Michel is:

℞	
Ichthyol. zinz ox., gelatini āā	5.0 gm. (3j 1-3)
Glycerini	
Aquæ dest. āā	25.0 c. c. (f5vi. mxxv)

Sig: The ointment for the lids to be warmed before applying.

C. T. Cadwell (p. c.) advises the following ointment in *angular conjunctivitis* and *corneal ulcer* due to the diplobacillus:

℞	
Ammonii ichthyol.	0.15
Zinc. oxid.	5.00
Vaselin. alb.	15.00

To be thoroughly mixed and applied both to the inside and outside of the lids.

### **Iodine.**

*I. Iodum. Tincture of iodine. Compound solution of iodine. Lugol's solution. Carbolyzed solution of iodine. Churchill's tincture. Decolorized tincture of iodine. Iodine caustic. Iodized carbolic acid. Iodized collodion.*

In the references to this ancient remedy the foregoing preparations have all been used in eye practice for the iodine they contain.

Iodine and its soluble preparations are generally *incompatible with* starch, oil of turpentine, tannin and the vegetable colors.

With the earlier ophthalmologists painting the forehead, lids and temples with the ordinary tincture of iodine was a favorite counter-irritant in scleritis and other acute and chronic diseases of the eye

associated with pain. It was also used as an application to the skin of the ocular region affected by erysipelas. The employment of tincture of iodine (or any of the preparations mentioned above) as a *cauterizing agent and germicide to corneal ulcers of the simple type* has been advised by several authorities. I have used it with good effect and if the globe and sac be well irrigated with a mild disinfectant (See Mercury bichloride) and the ulcer curetted, I know of no better agent for completion of the cure than one or two thorough applications (by means of a pointed toothpick soaked in the solution) of any of the iodine preparations.

*Painting the lids with tincture of iodine* is still a favorite remedy with some surgeons. Thus, Puech advises it to remove the deposits in *all forms of deep scleritis*, applying the remedy daily for five days. This procedure is occasionally employed in chronic iritis and other inflammations of the uveal tract. Its action is, of course, that of a counterirritant (q. v).

#### **Iodine Bichloride.**



The bactericidal power of this agent has been tested experimentally by several observers on typhoid, cholera, diphtheria, streptococci, staphylococci, tubercle bacilli, etc.; a 0.1 p. c. solution was found to be only slightly less efficacious than a 3 p. c. solution of carbolic acid, while the latter was considerably inferior to a 1 p. c. solution of trichloride of iodine.

In ocular therapy Felser\* has successfully employed, where an external astringent and antiseptic was indicated, a 0.02 per cent. solution.

#### **Iodine, Trichloride of.**



This is an orange-yellow deliquescent, crystalline powder, with a pungent, irritating odor. It is distinctly poisonous. It melts and decomposes at 25° C., and both in substance and solution must be protected from light and air.

I have used this agent in its pure form as a *cauterant in the simpler forms of corneal ulcer* and if the preliminary cleansing and other accessory precautions in the treatment of this disease are regarded I believe it to be a reliable agent for the purpose (see Cauterants). For subconjunctival injections Pflüger (66) advises a 1:2000 to 5000 solution in water and Birnbacher (67) uses it instead of sublimate for cleansing purposes, 1:1000 solution, in follicular conjunctivitis.

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\**Compendium der Arzneiverordnung*, 1891, p. 391.

**Iodine-vasogen.**

(See, also, *Vasogen*.)

J. A. Andrews (p. c.) uses this remedy in *corneal opacities and infiltrations*. He employs it in 5-10 *per cent. mixture*, making the application on a *cotton-tipped probe*, every other day until the infiltration shows signs of shrinking; then, according to indications, it may be applied every third day. Sometimes this remedy causes decided pain even in milder solutions. For this reason Andrews prepares the eye by washing it with normal salt solution, afterwards instilling a 2 *per cent. solution of alypin*. Before applying the iodine-vasogen, the excess tears should be carefully wiped from the eye, with cotton.

A. Duane (p. c.) also believes that this is a valuable application for the *removal of corneal opacities*.

**Iodized Glycerol.**

(See *Glycerine*.)

**Iodoform.**

*Formyl triiodide or teriodide. Triiodomethane.*  $\text{CHI}_3$

Made by various processes; one of these is by heating together iodine, potassium carbonate, alcohol and water. It crystallizes as minute, yellowish, hexagonal scales that are almost insoluble in water but dissolve in alcohol, ether, benzene and most of the volatile oils. It is unctuous to the touch and has an iodine-like taste and a most disagreeable, penetrating odor. On the market one finds the crystals just described and two forms of powder—the one quite light and the other heavy. As the microscopical crystals are not well adapted as a dusting powder for wounds and ulcers, either of the powders should be employed.

Local poisoning (iodoform eczema) as well as general disturbances are sometimes noticed. In the former instance irrigations of hot water and the application of calcined magnesia are the best remedies.

Many attempts have been made to disguise the smell of this valuable remedy, so obnoxious to eye patients. Ohlemann believes this is best accomplished by combining it with *cumarin* (q. v.). The National Dispensatory gives *iodoformum aromatisatum*, deodorized iodoform, as containing four per cent. of cumarin. It also states that the odor of iodoform may be removed by washing in an aqueous solution of tannin. For this purpose, also, the N. D. mentions 3 to 5 drops of oil of peppermint to the ounce. Peru balsam, oil of fennel and oil of anise are also effective. The odor of the drug clings even to instruments and dishes. These should first be rubbed with turpentine and then washed with soap and water.

Owing to the poisonous and ill-smelling qualities of iodoform nu-



merous compounds, claiming to be as efficacious an antiseptic but less poisonous and malodorous have been suggested from time to time. Among these may be mentioned iodoformogen, aristol, iodol, iodolen, iodolin, iodogallicin, iodoformal, iodoformin, iodylin, xeroform, isoform powder, antiseptol, euophen, losophane, the sozoidolates of sodium lead, potassium, zinc, mercury, lithium, aluminum and magnesium—especially the first—sulphaminol and thiophine. Any of these agents that have been successfully employed in ocular lesions are referred to elsewhere in this volume.

Iodoform is, on the whole, most efficient when applied as an extremely fine powder by means of an insufflator to wounds, corneal ulcers, to the parts involved in plastic operations, in diseases of the lachrymal sac, caries of bone, etc. It is also valuable as an ointment in the proportion 1:20 to 1:10. Dissolved in collodion it makes an excellent dressing for wounds of the ocular region. In the form of gauze iodoform is extremely useful for packing sinuses or as a dressing in evisceration of the orbit. In disease of the bone associated with dacryocystitis iodoform mixed with glycerin or oil has been recommended as an injection. In all these preparations it should be as finely divided as possible; there should not be visible even with a powerful lens the minutest crystals, for if present they act as irritants and one loses to some extent the purely antiseptic action of the drug.

H. Bailey (p. c.) uses the following *ointment* as an application in *phlyctenular keratitis and corneal ulcer*:

R

Pulv. iodoform.	5i
Atropiæ	gr. ii
Lanolin.	5i

To be thoroughly mixed in a mortar.

For the *hyperemia of the conjunctiva and the irritative symptoms* that sometimes accompany refractive errors and that occasionally persist after they have been properly corrected Hanford McKee (p. c.) prescribes *iodoform powder on a homatropin and cocain disc*, or a *little ointment of iodoform*—ten per cent strength.

In *wounds of the cornea and ocular region* generally C. L. Frey (p. c.) uses a *2 per cent. solution in olive oil*.

In addition to the use that every surgeon makes of this old and valued remedy (as a disinfectant dressing for operative and other wounds) Haab introduces into the anterior chamber *small rods or discs of iodoform* for the treatment of most forms of intraocular infection. He advises their use when the anterior chamber has been in-

fectured by pathogenic bacilli—as in hypopyon ulcer for example. They will also be found valuable in some cases of traumatic infection where, otherwise, enucleation would be indicated.

### **Iodofan.**

A monoiododioxybenzol-formaldehyd, produced by the action of iodine on formaldehyd and dioxybenzol. It forms a reddish-white powder, without odor or taste, which is recommended as a non-irritating antiseptic dressing for operative and other wounds, either as a *dusting powder or ointment*. It possesses bactericidal action, stimulates the healing process and acts, generally, as an *iodoform substitute*.

### **Iodol.**

*Tetraiodopyrrol. Pyrrol tetriodide.*  $C_4I_4NH$ .

A pale, yellow-brown, bulky, odorless, tasteless, partially crystalline powder—the oldest (1885) of the iodoform substitutes. It contains 90 per cent. of iodine, and is sparingly soluble in water; more soluble in alcohol, ether and the fixed oils.

Thomalla (57) recommends this remedy as a fine powder to be dusted on the cornea in phlyctenules of that organ. He regards it as a valuable substitute for calomel, while as an iodine preparation it can (dose, 5 to 15 grains) be taken internally at the same time.

It has been recommended as a dusting powder in herpes corneæ.

In *chronic catarrhal conjunctivitis* a small quantity of the following ointment has been advised for finger massage of the lid skin on the globe:—

R̄

Iodol.	2.00 (3ss),
Petrolati	10.00 (3iiss).

A similar use of iodol is made in *follicular conjunctivitis*, the salve being dispensed as follows:—

R̄

Iodol.	2.00 (gr. xxx),
Petrolati	
Lanolin.	āā 5.00 (5i gr. xv.),
Ol. rosæ	gtt. i.

### **Iodoformogen.**

*Iodoform albuminate.*

This is an odorless mixture of albumen and iodoform. It occurs as a fine, dry, yellow, voluminous powder which slowly liberates iodoform and does not form clots when in contact with the tissues. It is reported to be an effective, non-toxic and convenient substitute for

iodoform. It ought to be an excellent dusting powder and application to wounds in eye surgery.

### Iodopin.

#### *Iodized sesame oil.*

This agent is marketed by Merck in both 10 and 25 per cent. strengths of iodine. The latter mixture is intended for hypodermic use—the dose being 2 to 6 c. c. (30 to 90 minims) daily.

Although probably only a mixture of corn oil (oil of sesame) and iodine it is offered as a substitute for the sodic and potassic iodides so largely used in ophthalmic therapeutics. The drug seems to be well borne even for long periods of time. Its elimination is very slow, traces of it remaining in the urine 53 days after administration. It may be given by mouth in 10 per cent. strength, six teaspoonfuls a day, or as the oil inclosed in capsules. It may also be employed hypodermically in as large doses as 10 to 15 cc. of the 25 per cent. solution every two or three days. It can also be administered by inunction. Iodopin, indeed, may be given for all the conditions for which iodide of potassium has been used.

### Iodosyl.

Said by the proprietors (Nelson, Baker & Co.) to be a definite chemical compound containing a little over 65 per cent. of iodine, whose formula may be written empirically,  $C_7H_4O_3I_2$ . It is a bulky, amorphous, garnet-colored, odorless powder; non-irritating and does not stain the skin; insoluble in water and oils, slightly soluble in chloroform, alcohol and ether. It is said to be a powerful antiseptic and deodorant, decidedly analgesic and without toxic properties. The claim is made for it that it is of value in the treatment of *purulent ophthalmia*, *granular lids*, *ciliary blepharitis*, *pannus* and *ulcer of the cornea*. For this purpose an iodosyl ointment containing 2 per cent. of the drug in collapsible tubes is on sale. It may, however, be employed in greater strengths up to 6 per cent. or even 10 per cent.; or be used as a dusting powder.

H. McI. Morton (p. c.) places a small quantity of the salve in the conjunctival sac as an adjunct to the treatment of several forms of conjunctivitis, mainly for the purpose of preventing the lids from sticking together and allowing the secretion to drain away.

### Iothion.

#### *Diiodohydroxypropane. $C_3H_5I_2(OH)$ .*

A yellowish, heavy, oily liquid, soluble in from 70 to 80 parts of water, 20 parts of glycerine and 1.5 parts of olive oil. Very soluble in alcohol and ether, lanoline and petrolatum.

In from 5 to 15 per cent. ointment it has been recommended as an

application in *blepharitis*. Internally, as *inunctions* and in the *subcutaneous form*, it has also been prescribed for vitreous hemorrhages, choroiditis, iritis and optic atrophy in about the same dosage as iodine.

### **Isophysostigmin.**

Before the St. Petersburg Ophthal. Soc., December 14, 1906, Nikanarow claimed that a 1-10 per cent. solution of the salicylate is well borne by patients. Three drops caused a distinct lowering of the intraocular tension and this decrease lasted longer than that caused by a one per cent. eserine solution. Isophysostigmin does not irritate the eye and cause pain, as is often the case with a one per cent. solution of eserine. In the former case, also, the ciliary spasm set in earlier and lasted longer than that due to eserine. A hyperopia of 4 diopters was converted into an apparent myopia by the use of the drug. After two months' constant use there were no traces of hyperemia of the conjunctiva. Although it is two or three times dearer than eserine, the smaller dosage makes its use comparatively inexpensive, while Nikanarow believes it is a more effective drug than eserine.

*Isophysostigmine* has also been investigated by Ogiu\* who found that it acts much more quickly upon the pupil, and with greater energy and for a longer period than physostigmine. Stephenson thinks, from his experience in the treatment with it of a case of conical cornea that, although it is a powerful and efficient miotic it is prone to act as an ocular irritant.

### **Isophysostigmine Sulphate.**

This salt of an alkaloid found with *eserine* (physostigmine) in Calabar bean (q. v.) is quite soluble in water and acts as a *powerful miotic*. Merck says that 1-80 gr. is equal in this respect to 1-60 gr. of eserine sulphate. Solutions should be kept in amber bottles.

### **Itrol.**

*Silver citrate.*  $C_6H_5O_7Ag_8$ .

A white, heavy, odorless powder which darkens on exposure to light. It is used where a dry, non-corrosive antiseptic is required. It is made by precipitating a solution of silver nitrate by means of citric acid and sodium bicarbonate.

This agent is barely soluble (1:4000) in water. It is consequently mostly used as a powder for dusting wounds, upon the conjunctiva, etc., forming a valuable non-irritating antiseptic. Paul Meyer (19) found it especially useful in infected wounds of the lids, conjunctiva and orbit, and advises that it be blown on them with an insufflator. Good results almost always followed, even in infected wounds of the

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\*Die Therapie der Gegenwart, Nov., 1904.

eyeball, when this product was applied to the wound. In fact, in all the commoner, infectious, external diseases itrol was found useful, with the exception of tuberculous infections. Some pain is felt but this is due to the mechanical effect of the insufflation. Insufflation is necessary, however, as one must have penetration, and cocain may be employed to allay the irritation. It is always necessary to use fresh itrol made by a reliable chemist.

#### Jaborandi.

(See *Pilocarpin*.)

#### Jequiritol.

The use of jequirity (q. v.), either in powder or infusion, for the treatment of pannus has unfortunately fallen into abeyance in America, mainly because of the variable dosage and its dangerous and uncertain action. Römer (23) has sought to remedy these defects in an otherwise valuable agent by the careful manufacture, from the *abrus precatorius* of a definite compound containing 50 per cent. glycerine which he has called jequiritol. He believes this to be a more reliable preparation than abrin (q. v.), the infusion or the powdered seeds. It is made in four different strengths. The treatment begins by the instillation of a single drop of No. 1 on the first day, the dose being gradually increased in amount and strength until a well-marked jequirity inflammation is set up. Should the inflammatory reaction at any time be too severe it is controlled by dropping into the eye a small quantity of jequiritol serum (prepared on the principle of Behring's serum) repeated as often as necessary or, if the reaction be excessive, by its hypodermic use. Both remedies are prepared and sold in a box—with full directions for use—by Merck & Co. I have had considerable experience with this remedy and recommend its use to my colleagues in *pannus trachomatosis* especially.

#### Jequirity.

(See *Abrus precatorius*, *Jequiritol* and *Abrin*.)

#### Kummerfeld's Lotion.

This is a collyrium well known in Germany, applied as compresses or used as eyewater at night in the home treatment of blepharitis. The formula is:

R

Camphoræ	0.40 (gr. vi)
Lactis sulphuris	4.0 (ʒi)
Aquæ calcarizæ (P. G.)	
Aquæ rosæ	āā 40.0 (f ʒ 1¼)
Gum. acaciæ	0.8 (gr. xii)

**Labarraque's Solution.**

(See *Solution of chlorinated soda*.)

**Lactic Acid.**

(See *Acid, lactic*.)

**Lanolin.**

*Adeps lanae hydrosus. Hydrous wool-fat.*

Sheep's wool-fat purified for medicinal purposes and containing 25 per cent. of water. A whitish-yellow, neutral, fatty mass having a peculiar wool-like odor, easily miscible with twice its weight of water.

This remedy is used alone as an application to excoriated lids, in various forms of blepharitis and as an excipient in combination with other agents. I have found it of too stiff consistence for general use in these conditions and generally order it diluted with water, cold cream or petroleum. It ought, *a priori*, to be the ideal base for salves, as it is an animal product derived from dermal oil glands but, clinically, it does not strike me as superior to pure lard and other fatty products. In lesions at the external canthus, however, its adherent qualities enable it to resist well the action of the tears and for that reason it is well adapted for ointments to be applied in that locality.

Darier (*Thérapeutique Oculaire*, p. 21) advises for finger massage *mercurial lanoline*. This is a preparation put up by certain Paris druggists in gelatine capsules, each containing four grammes. He believes this preparation undergoes slighter alterations, is more easily absorbed than similar preparations of mercury and is, consequently, well adapted to lid friction.

Vacher uses for the same purpose what he calls *compound gray oil*. This, Darier says, has about the same formula as his mercurial lanoline.

**Lapis Divinus.**

*Cuprum aluminatum. Aluminated copper.*

This agent is prepared by fusing together copper sulphate, potassium nitrate, alum and camphor. The semi-liquid mass may be moulded into *pencils*. It is a bluish, noncrystalline mass with a greasy appearance. For several years I have been in the habit of using this stick as a substitute for crystals of sulphate of copper in trachoma, etc., and believe it to be just as efficacious and much less disagreeable to the patient than the pure copper sulphate. In the French pharmacopeia an eyewater—used in trachoma and other forms of granular lids—is official under the name *collyre de pierre divine*. This is made by dissolving 4 parts of aluminated copper in 1000 parts of water.

Another prescription is as follows:



℞

Cupri aluminati	0.05—0.1 gm. (gr. 7-16 ad iss)
Aquæ dest.	120.0 c. c. (℥iv)
Tincturæ opii	0.2 c. c. (m iij)
Glycerini	2.0 c. c. (f ʒ ss)

Misce et fiat in collyrium.

After applications of the solid compound one should flush the eye with a mild, aseptic wash such as one per cent. salt water, or a two per cent. borax or boracic acid solution.

#### Lard.

*Adeps. Adeps suillus. Axungia porci.*

The purified abdominal fat of the hog; a soft, white, unctuous solid, with a faint, non-rancid odor. The most important constituent of lard is stearin. It is commonly used in ocular therapy as a basis for ointments. For example:

℞

Hydrargyri oxidi flavi	0.2 gm. (gr. iii)
Ceræ alb.	1.5 gm. (fr. xxij)
Adipis	3.5 gm. (gr. lix.)

The value of pure lard alone as an emollient in marginal blepharitis must not be forgotten. It is quite likely that the good results that flow from ointments are often due to the presence of the greasy excipient and not to the supposedly active ingredients.

#### Largin.

*Silver-protalbin.*

A grayish powder containing about 11 per cent. of silver; soluble in 10 parts of water, insoluble in ether and alcohol. It is a bactericide and astringent and belongs to the numerous class of argentic nitrate substitutes.

In from 2 to 10 per cent. solution it may be applied with a brush over the exposed conjunctiva once or twice a day. Its application, even in the concentrated form, is painless, but may stain the conjunctiva. It acts well in blepharo-conjunctivitis and in some cases of dacryocystitis, and forms a valuable substitute for silver nitrate in the Koch-Weeks bacillus infections.

#### Lead Acetate.

*Plumbi acetat. Normal or neutral acetate of lead. Sugar of lead.*  
 $\text{Pb} (\text{C}_2\text{H}_3\text{O}_2)_2 + 3\text{H}_2\text{O}.$

This salt occurs as shiny, colorless, transparent, tabular prisms having an odor of vinegar and a sweetish, astringent and metallic taste. It is freely soluble in water; less soluble in alcohol. It loses its water of crystallization and becomes translucent at 40° C.

Lead salts are mostly *incompatible with* the following: acids, sulphates, citrates, tartrates, chlorides, carbonates, alkalies, tannin, salicylic acid, phenol, as well as vegetable infusions and tinctures.

Although most text-books continue to include this agent among the astringents useful in conjunctival diseases, I believe it is about time to drop it from modern lists, especially as we possess so many more potent substitutes. If used at all it should be in very weak solutions, say, ten drops or less of *liq. plumbi subacetatis dilutus* to the fluid ounce of distilled water. All the soluble salts of lead are contra-indicated in abrasions or ulcerations of the cornea owing to the danger of permanent staining (q. v.) from a deposit of plumbic albuminate or other insoluble lead compounds in the lesion-area. A salve of neutral lead acetate in the paraffin ointment (q. v.) of the German pharmacopeia (1:400) is said to be less irritating and more effective than solutions and to be less likely than they to stain the cornea. However, I do not see why we should use any agent likely to leave hurtful sequelæ when other remedies equally effective are at hand.

As an application for the *pain of either iritis or glaucoma* R. L. Randolph (p. c.) has much confidence in the so-called Japan "hot-box" with the following, used as a fomentation:

R

Plumbi. acetat. ℥ ii

Pulv. opii ℥ss

Mix with a quart of boiling water.

Stephenson advises the use of a *one per cent. ointment* of the subacetate of lead in *follicular conjunctivitis*. A small piece is applied to the everted conjunctiva once a day. After two weeks' time the strength of the ointment is doubled, the application being followed by massage. Under this treatment the hyperemia disappears, the discharge is less, the follicles become reduced in size and eventually disappear.

#### Lead Water.

*Liquor plumbi subacetatis dilutus* U. S. *Aqua plumbi* P. G. *Aqua saturnina*.

Most of these contain about one per cent. of lead subacetate and when made up with alcohol are commonly known as *aqua plumbi Goulardi*, *Goulard's lotion or water*, just as the stronger solution is known as *Goulard's Extract*.

In Europe this solution is employed as a popular application in compresses, douches, sprays and collyria, but the same objection that applies to other local remedies containing lead acetate (q. v.) also applies to this one; it is likely to permanently stain the transparent

cornea in lesions of that organ. Inasmuch as this danger is unknown to the patient, who may develop a corneal ulcer before he consults a medical man, it is best to discourage the popular as well as the professional use of this remedy.

**Lemon Juice.**

(See *Acid, citric.*)

**Lenicet.**

This is a *basic aluminum acetate* (q. v.) with the formula  $\text{Al}_2\text{O}_3 (\text{C}_2\text{H}_4\text{O}_2)_2$ , a very fine, voluminous, white powder very slightly soluble in any fluid.

Wolfberg has found a *ten per cent. ointment with vaseline* of great use in *gonorrhea neonatorum, ulcerative blepharitis and burns*. It is also a good basis for scopolamine and atropine ointments for the treatment of catarrhal corneal ulcers and *ulcus serpens* and for the combined use of dionine and atropine, as suggested by Arlt.

**Lime, Chlorinated.**

*Bleaching powder. "Chloride of lime." Calcium hypochlorite.*

A variable compound of calcium chloride and calcium hypochlorite with water that should yield not less than 35 per cent. of chlorine. It is a deliquescent, white powder with an unpleasant odor and taste. It is partly soluble in water and is sometimes employed, *like chlorine water*, in eye diseases as a disinfectant *collyrium* in 4 per cent. solution. As a *compress* (15 to 30 parts in 1000) it is occasionally prescribed.

**Lime Permanganate.**

*Calcii permanganas. Calcium permanganate.*  $\text{Ca}(\text{MnO}_4)_2 + 5\text{H}_2\text{O}$ .

A violet-colored, crystalline substance, soluble in water. It is said to be 100 times more powerful than the potassium salt and more valuable than mercuric chloride as a germicide. Kalt, who has had much experience with the use of large volumes of irrigating fluids in infections of the eye, considers this salt to be a very valuable disinfectant and advises its use—1 gramme to 3 litres of water at 25° C. One eye to be irrigated with this solution from two to four times daily, alternating, if need be, with irrigations of warm, sterile water.

**Lime Water.**

*Aqua calcis. Liquor calcis* U. S. *Aqua calcaria* P. G.

A saturated, aqueous solution (0.14 per cent.) of calcium hydroxide.

About the only use to which this solution is put in ophthalmic therapy is in the manufacture of cold cream (q. v.), in making "black wash" and for other subsidiary purposes.

**Liquor Potassae Arsenitis.**

(See *Fowler's solution.*)

**Loretin.**

This is a complex organic acid occurring as a yellow, crystalline powder insoluble or only slightly soluble in water and alcohol. It has been put forward as a substitute for iodoform. Nicati has advised its employment as a dusting powder for diphtheria of the conjunctiva in the following mixture:—

℞

Loretin.

Calomel.

āā 1.00 (gr. xv)

Pulv. acid. boric.

50.0 (℥ii)

This should be dusted on the infected areas, as well as upon the lids and the whole covered with a sterile cotton dressing.

**Lotio Nigra.**

*Lotio hydrargyri nigra*. P. Br. *Black mercurial lotion*.—*Aqua nigra*.  
*Aqua mercurialis nigra*.

(See *Aqua ophthalmica nigra*.)

**Lysargin.**

A new form of colloidal silver appearing as *shiny lamellæ* of a *steel-blue color*. These are readily soluble in water, forming a yellowish-brown solution, which may be used for the *same purpose* as *collargol*.

**Lysol.**

A mixture of the higher phenols with resinous and fatty soaps, made by boiling heavy tar oils, fat and resins with alkalies. It is a brown, oily fluid with a peculiar, creosote odor; contains about 50 per cent. of cresols; soluble in water and alcohol.

Although it has been proposed to use this agent as a disinfectant (in proportion of 1:5000 to 1000) and as a germicide collyrium in ocular diseases, I know of no extensive trials of it in that capacity. On the other hand, it acts admirably in 2 to 4 per cent. aqueous solutions as a disinfectant hand lotion and for the sterilization of instruments.

**Lysoform.**

This is a *liquid formaldehyde potash soap*, highly antiseptic, only slightly poisonous, odorless, deodorizing and cheap. It does not coagulate albumen and mixes readily with alcohol in all proportions. Owing to its highly bactericidal qualities it is extremely useful for *washing the hands in ophthalmic operations*. A two or three per cent. solution is sufficiently strong for general purposes.

In addition to its use as a hand and skin disinfectant it is occasionally applied as a 2 per cent. ointment in the *eczematous and squamous forms of blepharitis*.

### Mackenzie's Eye-wash.

The formula for this eye-wash (*Indian Medical Gazette*, Nov., 1907) is as follows:

Corrosive sublimate 1, ammonium chloride 6, belladonna extract 10, coccus cacti 1½, proof spirit 55; rub together and add water to 330. Mix with equal parts of boiling water to bathe the eyes. The Extra Pharmacopeia cautions us that the foregoing collyrium is about five times as strong as is usually employed in ophthalmic therapy. I would like to add that American eyes would be the better for a collyrium of 1-10 strength.

### Magnesia, Calcined.

*Light magnesia. Light magnesium oxid. Magnesia. Magnesia usta.* MgO. A very light, white powder with a slightly alkaline taste.

Occasionally used as a powder to abrasions of the lid.

The following collyrium has been highly recommended in the treatment of "pink-eye" by J. G. Thompson (p. c.), in which, doubtless, some *magnesium borate* is formed.

R

Acid. boric.

5iss.

Magnesia calc.

℥ ss.

Aquæ dest.

fl. ʒiii

Mix and filter. A few drops to be used in the eye every four hours.

### Magnesium Sulphate.

*Epsom salts. Bitter salt.* Mg SO<sub>4</sub>+7H<sub>2</sub>O.

Small, colorless, odorless, bitter, saline needles, very soluble in water, insoluble in alcohol.

This salt is rarely used as a local application in eye disease, but E. E. Holt (p. c.) advises that in any sthenic inflammation about the eye with swelling of the lid or conjunctivæ, the application of a *saturated solution in several thicknesses of gauze*, bound comfortably tight about the orbit during night time, will materially help to check the inflammation.

### Mercurial Ointment.

*Unguentum hydrargyri. Gray ointment.*

A triturated mixture of oleate of mercury, metallic mercury, benzoated lard and prepared suet, containing 50 per cent. of metallic mercury.

This, the favorite mixture for inunction in the treatment of ocular lues, is occasionally applied (in 10 per cent salves) like the mercury oxides, to the lids and palpebral margins for dermal affections. The disagreeable odor, the staining of the skin and the fact that the remedy

is inferior for this purpose to other remedies limits its employment in this neighborhood.

### Mercurial Preparations.

#### *Mercury, salts of.*

So far as ocular therapy is concerned, the classic salts of mercury are the oxides (especially the yellow or mercuric oxide) calomel and corrosive sublimate. Many writers, Hirschberg in particular, warns us against prescribing potassic iodide internally during the topical use of the soluble mercurials; or at least not to use the latter until several hours after taking the iodide so as to allow elimination of most of the potassium salt. Calomel, among its other uses, has long been employed, especially in Europe, as a fine powder for dusting into the sac in cases of phlyctenular conjunctivitis; it should be avoided when the cornea is affected.

Most mercury salts are also *incompatible with* the following external ophthalmic remedies: albumen, the alkalies, alkaloids and their salts, borax, copper salts, gelatine, lead salts, silver nitrate, zinc salts and vegetable astringents.

Owing to its insolubility in water and other bland fluids the *oxide of mercury*—especially the yellow oxide—is commonly employed in the form of ointment and it still continues, as “Pagenstecher’s” ointment or some modification of it, to be one of the most frequently prescribed of all local eye remedies. Probably the greatest mistake made in American prescriptions of yellow oxide is to order too strong doses. An ointment of 1-10 per cent. of the yellow oxide, *thoroughly mixed*, will be found more useful, more comfortable and more effective than the usual one per cent. mixture of the same drug.

*Aqueous solutions of mercuric chloride* are of acid reaction and are very irritating to the eye when used in germicidal doses, i. e., 1 to 3,000. In weaker solutions (1:5,000 to 10,000) and especially when combined with borax, boracic acid or common salt, it forms a cool and soothing eyewash for irritable eyes. I do not know of a more effective mixture than the following:—

R

Sodii boratis

Acid. boric.

āā 2.00 (ʒss)

Sol. hydrarg. bichlor. (1:10,000)

30.00 (fl. ʒii)

The use of bichloride solutions in hypodermic and *intraocular injections* (q. v.) as well as the employment of other mercurial preparations will be considered under their proper headings.

(See, also, *Calomel*.)



## CHAPTER XXVII.

### REMEDIAL AGENTS EMPLOYED IN THE LOCAL TREATMENT OF EYE DISEASES—CONTINUED.

*Mercuriol—Mercurous Chloride—Mercury Ammoniated—Mercuric Benzoate—Mercury Bichloride or Perchloride—Mercury Cyanide—Mercury Ointment—Mercury Oleate—Mercury Oxycyanide—Mercury, Red Iodide of—Mercury, Red Oxide of—Mercury, White Precipitate of—Mercury, Yellow Oxide of—Methylatropine Bromide—Methylene Blue—Methyl Blue—Milk—Monochlorophenol—Morphia—Muriatic Acid—Muscarine—Mydrin—Mydrol—Myrrh—Nargol—Nirvanin—Novargan—Novocain?—Oleo-balsamic Mixture—Olive Oil—Opium—Orthoform—Osmosine—Pagenstecher's Ointment—Paraffin—Paraiodophenol—Paranephrin.*

#### **Mercuriol.**

*Mercury nucleide. Mercury nucleinate.*

A compound of mercury and nucleinic acid containing about ten per cent. of the former; a light brown-white powder, soluble in water, insoluble in alcohol.

This is an effective antiseptic, astringent and bactericide recommended in infectious conjunctivitis—especially in *ophthalmia neonatorum* in 2 to 5 per cent. collyria. Solutions should always be freshly prepared.

#### **Mercury, Ammoniated.**

(See *Mercury, white precipitate of.*)

#### **Mercuric Benzoate.**

Hg.  $(C_7H_5O_2)_2$ .

White crystals, soluble in solutions of sodium chloride and ammonium benzoate. The mercurous salt is insoluble.

Mercury benzoate is used by some ophthalmologists as a *substitutæ for sublimate and other mercurials in the hypodermic treatment of luetic affections of the eye*. This method is less painful than with most other salts of mercury. Armaignac (27) believes that the results are at least equal to those obtained by the use of the other salts. Of its use in non-specific cases he is noncommittal. The salt is employed in the following solution: Benzoate of mercury 1 gram; benzoate of ammonia, 3 grams, with 100 grams of distilled, sterilized water.

According to Merck's Index the internal dose is gr. 1-30—1-10

(0.002—0.006 grm.), while hypodermically 15 minims (1cc.) of the following solution may be used as indicated:

R

Hydrarg. benzoat.

Sodii chloridi

āā 0.25

Aquæ dest.

30.00

**Mercury Bichloride or Perchloride.**

*Corrosive mercuric chloride, U. S. Corrosive sublimate. Sublimate.*  
 $\text{HgCl}_2$ .

Occurs as heavy, white, odorless, transparent, crystalline masses with an acrid, metallic taste. It is quite soluble in water, alcohol and camphor solutions; the aqueous solution has an acid reaction, and is a powerful poison.

Mercuric chloride is one of the most useful of germicides, and when employed with due care forms an almost indispensable agent in the treatment of eye diseases. Hirschberg believed mercuric chloride, in solutions of 1 to 5000 to 1000, to be the most important remedy the ophthalmic surgeon possesses. He uses it with compresses, for irrigating the conjunctival sac before operations, for the cleansing of wounds old and new, for moist dressings in the after-treatment of operations, as an antiseptic collyrium and as a disinfectant solvent for alkaloids and other therapeutic agents. It may be applied as an ointment (see White's Ointment) or in solution. In the latter case it is prescribed alone or in conjunction with other remedies with which it is not chemically incompatible, but it is too powerful an escharotic to be applied pure to any of the ocular tissues.

As a mild astringent and antiseptic collyrium it may be used in 1:20,000 to 5,000 solution; as a detergent wash, irrigating fluid or spray a warm 1:10,000 solution will be found sufficient, while decided germicide qualities will be found to reside in solutions of 1:3,000-1,000. A most useful detergent and mild antiseptic collyrium is the following:

R

Acid boric

3 ss (grm. 2.0)

Sol. hydrarg. bichlor. (1:10,000)

fld. ʒi (c. c. 30.00)

In that form of *conjunctivitis* often seen with "grippe" R. L. Randolph (p. c.) has found this combination useful:

R

Hydrarg. bichlor.

gr. 1/12

Cocain. mur.

gr. i

Adrenalin. chlor. (1:1000)

ʒi

Aq. dest. ad.

ʒiii

I find this simple mixture (and a small amount of borax may,

with propriety be added in most cases) more soothing and less likely to irritate than the plain bichloride solution.

I have also found corrosive sublimate a useful application to *corneal ulcers* in a one per cent. alcohol solution. Stronger mixtures form efficient escharotics. Hirschberg long ago advised the use of 1:5,000 bichloride solution in water as an efficient preventive of germ growth in collyria.

In ordering mercuric chloride for eye lotions the chemist should be directed not to use tablets or alcohol in the preparation of the collyrium—as he may do, without thinking how irritating the excipient of the tablet (ammonium chloride, etc.) or the spirit may be to an irritable or inflamed eye.

Under various headings will be described a number of substitutes for mercuric chloride (formaline, sublimine, oxycyanate of mercury, zinc chloride, phenol, etc.) where their advantages and drawbacks are discussed at length. Here it will, perhaps, suffice to say that few antiseptics have proved as effective and have held their place as long in popular favor as corrosive sublimate.

### Mercury Cyanide.

*Cyanuret of mercury.*  $\text{Hg}(\text{CN})_2$ .

Occurs in white, odorless, prismatic crystals with a bitter, metallic taste; soluble in both water and alcohol. Very poisonous. It is permanent in air if the light be excluded. It is used subconjunctivally; otherwise in 1:20,000-5,000 solutions as a substitute for corrosive sublimate, than which it is less irritative.

H. W. Woodruff (p. c.) strongly advises *subconjunctival injections of solution of cyanide of mercury* in purulent infections of the eye-ball, such as *ulcers of the cornea*, *hypopyon keratitis* and *infections following cataract extraction*. He has become convinced that this method of treatment, if used in the first twenty-four hours, will check such a process. In the post-operative infection known as *ring abscess*, he has proven certainly to himself and to others that this method, if used early, even when the ring of exudate is distinctly seen, will check the purulent process.

D. C. Bryant (p. c.) uses the following formula in *nearly all forms of conjunctivitis*:

R

Acid. boric.

3i

Hydrarg. cyanid.

gr. ss,

Aquæ dest.

fl. ℥vi.

He very much prefers the cyanide of mercury to the bichloride

long experience with it has convinced him that it is a better germicide and less irritating.

Burtón Haseltine (p. c.) has used subconjunctival injections of *oxycyanate of mercury* in three cases of *sympathetic or transferred ophthalmitis* with better results than could have been reasonably expected from other forms of treatment. From three to five drops of a 1-2000 solution were injected into the sympathizing eye every two, three or four days, according to the severity of the symptoms.

H. J. Hornbogen (p. c.) prefers the following formula in *phlyctenular* and other forms of *corneal ulcers*.

R

Dionin.	gr. v
Cocain. mur.	gr. iii
Sol. hydrarg. cyanid. (1-4000)	q̄ ʒi.

In 1901\* I drew attention to its employment in conjunctival catarrh. After cleansing the mucous membrane it is to be touched lightly with a cotton swab soaked in the following solution:—

R

Hydrarg. cyanid.	1.00 (gr. xv)
Aquæ dest.	100.00 (fl. ʒiijss)

This should immediately be washed off with distilled water.

#### **Mercury, Ointment of.**

(See *Ointment of mercury*.)

#### **Mercury Oleate.**

A solution of *yellow mercuric oxide* in oleic acid. Yellowish, semi-solid mass, soluble in ether and oils. The U. S. P. has a 25 per cent. mixture. Ball (*Text-book*, p. 118) advises the use of this mixture as an application in *seborrhoea of the lid skin*:

R

Sulphur precip.	
Hydrarg. oleat. (5 per cent)	āā part. equal.
Ungt. aquæ rosæ	q. s.

Make into an ointment.

#### **Mercury, Oxycyanide of.**

*Mercuric oxycyanide*. *Hydrargyrum oxycyanatum* P. G.  $\text{HgO}, -\text{HgCN}_2$ .

A white crystalline powder, with a yellowish tinge, soluble in 17 parts of water.

This salt is used as an *antiseptic substitute for mercuric bichloride* in 1:2,000 to 1:500 solutions, being generally regarded as about one-

\*Hare's *System of Therapeutics*, III, p. 663.

fourth the strength of the latter. It is used in exactly the same way as sublimate without exhibiting its irritating properties.\* It is much less injurious to instruments and may, accordingly, be used as an antiseptic in preparing them for operation.

Merck announces (*Annual Reports*, 1907) that he prepares two different salts; one a pure oxycyanide styled *Hydrarg. oxycyanid.*, *Holdermann*, and another prepared by the old process and designated *Hydrarg. oxycyanid. cryst.* As most of the reported observations have evidently been made with the latter variety, it is doubtful whether the observed effects are due to the oxycyanide or the cyanide. Mercuric oxycyanide does not attack metals, and has therefore been found useful for disinfecting surgical instruments; for this purpose a half to one per cent. solution, with the addition of 5 per cent. sodium carbonate or bicarbonate, is used. As an antiseptic it is equal in effect to sublimate, while it does not corrode instruments, injure the hands, or precipitate albuminous solutions.

Hirsch\*\* uses *subcutaneously* a preparation of 1 per cent. aqueous solution of *oxycyanide of mercury with 0.5 per cent. acoin*, made by a special method in the Heyden chemical works. He has treated 20 cases of congenital and acquired syphilis. Pain was practically absent in all the cases, and the site of injections remained free from reaction. Hirsch injected at intervals of 2 to 4 days 1 to 1½ ccm. in adults and correspondingly smaller doses in children. The injections were made subcutaneously on both sides of the spinal column. According to Hirsch the injections work more rapidly and permanently than inunctions. In *iritis synechiæ* are prevented, and the extension of inflammation in parenchymatous keratitis is checked. This soluble salt of mercury is very rapidly excreted. Eight days after the last injection, the urine shows no trace of the mercury.

In *blennorrhæa neonatorum* some surgeons prefer it to silver nitrate or corrosive sublimate, using it as an irrigating fluid twice or three times daily in 0.20 per cent. solution.

The oxycyanide is preferred by an increasing number of surgeons to the bichloride in treating eye diseases. Haitz (38) has found it, in the same dosage, of at least equal value to the sublimate as a subconjunctival injection in central choroiditis, vitreous opacities and other intraocular diseases.

Kenneth Scott, who has enjoyed unusual opportunities of

\*Ohlemann (Oliver's translation) quotes Schlösser as saying that it may be used as an eyewater for conjunctivitis in one or two per cent. solution.

\*\**Wochenschr. f. Therapie des Auges*, June 28, 1906. (Abstract from *Annals of Ophthalmology*.)

studying the disease in Egypt, treats *chronic trachoma* by painting the lids with a four per cent. solution followed by the home use of a 1:500 to 1:1,000 solution as an eyewater. As a germicidal douche in *corneal ulcer* due to infective conjunctivitis it is extolled by several writers, while in the conduct of *chronic dacryocystitis* with pus formation it acts better than any other mercurial.

Solutions of the oxycyanide do not precipitate cocain, as mercuric chloride does, and for the purpose of preventing decomposition in these anesthetic solutions ought for that reason to be preferred to the latter.

#### Mercury, Red Iodide of.

*Mercuric iodide. Biniodide of mercury. Hydrargyrum bijodatum, P. G. Hydrargyri iodidum rubrum. Hgl<sub>2</sub>*

A heavy, scarlet-red, amorphous or crystalline powder. It is almost tasteless and quite inodorous. It turns yellow at 150° C., slowly returning to red. It is a powerful irritant poison, like the bichloride.

It is well to remember that neither calomel nor any other salt of mercury should be applied to the conjunctival sac if iodides are being taken internally lest an irritating mercuric iodide be formed.

This remedy is rarely employed as an eye water. One of the elder von Graefe's formulæ, to be used as a stimulating collyrium in corneal infiltrations, especially in parenchymatous keratitis, is:

R

Hydrarg. biniodidi	0.3 gm. (gr. iv)
Potass. iodidi	3.0 gm. (gr. xvi)
Aquæ dest.	30.0 c.c. (f3vii).

Sig.—Five drops to be instilled 3 times daily.

For *aborting styes* the following mixture has been recommended:

R

Hydrarg. iodidi rubri	0.40 (gr. vii)
Ol. olivæ	100.00 (fl. ʒiii¼)

This should be applied several times daily to the incipient sty. In the *recurrent forms* of the disease also smearing the lid edges

daily for three months with the following has been advised:

R

Aristol.	0.50 (gr. vii ss)
Petrolati	
Lanolin.	āā 5.00 (ʒiiss).

Lanvole recommends for this purpose, also, bathing the lids regularly with:



℞

Acid. salicylic	5.00 (℥ iss)
Boracis	3.00 (gr. xlv)
Aquæ dest.	30.00 (fl. ℥j)

In the *ulcerative form of blepharitis* when the lesions do not readily heal they may be curetted and have applied to them on a cotton swab a small quantity of this solution:

℞

Hydrarg iodid. rubi	
Ol. olivæ	250.00 (fl. ℥viii).

The red iodide is sometimes employed as an ointment (1:1.000) in *ulcerative forms of blepharitis* but for that purpose milder salts of mercury are generally preferred.

#### Mercury, Red Oxide of.

*Red precipitate.* Hg O.

A heavy, bright, orange-red powder. Insoluble in water or alcohol but very poisonous.

This mercurial preparation was occasionally used in the place of and for the same purposes as the yellow oxide (q. v.) but owing to its milder, less irritant and equally effective action the latter salt is now invariably preferred. Schmidt-Rimpler has advised its employment as an ointment, in the proportion of 1:16, for syphilitic lesions of the lid. Owing to its insolubility in water or fluids commonly used as menstrua in ocular therapy it is not employed as a collyrium.

#### Mercury, White Precipitate of.

*Ammoniated mercury. Mercuric ammonium chloride.*

White precipitate is a white, inodorous, amorphous powder with an earthy, metallic taste and poisonous properties. It is insoluble in water and decomposes when exposed to it.

This remedy is used instead of the yellow oxide, where that drug is indicated, in ointment form, and is regarded by some surgeons as superior to Pagenstecher's salve because it is less irritating. It combines readily with all the ordinary excipients and in suitable cases makes an excellent application in lesions of the lid edges and to the conjunctival sac. It is commonly ordered in from 1:100 to 1:10 strengths.

#### Mercury, Yellow Oxide of.

*Hydrargyrum oxydatum*, P. G. *Yellow Mercuric oxide. Precipitated, or yellow precipitated, oxide of mercury. Hydrargyri oxidum flavum*, U. S. HgO.

This is a heavy, smooth, odorless, tasteless, amorphous, yellow-red powder, darkened by exposure to light, which partially decomposes

it with the formation of mercurous oxide. It is insoluble in water and ordinary fluids. Yellow oxide is more finely divided than the red oxide, hence is more easily acted on chemically and has a more marked therapeutic action.

Practically the only use made of this agent is in the preparation of the so-called Pagenstecher's ointment (q. v.) or "yellow salve" so extensively employed in ophthalmic surgery.

In one of its strengths it constitutes the *unguent. hydrarg. flav.* U. S. and ought to be ordered under that caption, diluted, when necessary, with petrolatum, lanolin or other excipients.

### **Mercurio-Zinc Cyanide.**

#### *Lister's antiseptic.*

A white powder obtained by precipitation from a saturated solution of the cyanide of mercury and potassium and a saturated solution of zinc sulphate. In this powder the two cyanides are combined in somewhat varying proportions; it should contain at least 20 per cent. mercury cyanide,  $\text{Hg}(\text{CN})_2$ .

As is well known this is one of the *most powerful antiseptic solutions* that the ophthalmic surgeon can make use of as a lotion for the eye. In *infectious conjunctivitis* and similar conditions it is used in 1-5,000 to 20,000. The *Moorfield's Pharmacopeia* gives a salve containing one or two per cent. of the double salt in soft paraffin for use in *burns of the lids and for granular lids*. This ointment is known in the Royal London Ophthalmic Hospital as *Silcox's ointment*.

### **Methylatropine Bromide.**

#### *Atropine methylbromide.*

Occurs in white crystals soluble in water. It is recommended as an atropine substitute in 3 per cent. solution or 1 per cent. ointment. It has also been successfully used by Aronheim in conjunctival catarrh and corneal infiltrations. He thinks it is best combined in the following prescription:

℞		
Methylatropin. brom.	grm.	0.003
Aque dest.		
Hydrarg ox. flav.	āā grm.	0.2
Lanolin.		io.

Methylatropine bromide,  $\text{C}_{18}\text{H}_{26}\text{NO}_3\text{Br}$ , was introduced by Merck in 1902. It has advantages over atropine in that it is much less poisonous, while the mydriases and cycloplegia from a 2 to 3 per cent. solution set in as quickly and are as complete as that of a 1 per cent. atropia solution, but disappear much sooner. Darier uses it chiefly for *ophthalmoscopic purposes* and finds that a single drop of a half per

cent. solution is quite sufficient to produce effective and transient dilation of the pupil with little or no paresis of accommodation. Winselmann uses a still weaker solution (0.25 per cent.) because he finds stronger doses occasionally cause ciliary paresis and mydriasis lasting 24 hours. I much prefer to any of these agents a mixture of cocaine and euphthalmine (q. v.).

D. Bruno (*Riforma Medica*, Vol. 22, 1906, No. 4) advises as a most powerful prescription in cases of *iritis complicated with secondary glaucoma*, the following:

R

Atropin, methylbromid.	0.10 (gr. $1\frac{1}{2}$ )
Tropacocain.	0.05 (gr. $\frac{5}{8}$ )
Paranephrin. (solut. 1:1000)	m. x.
Aquæ destil. steril.	10.0 (f. $\frac{5}{3}$ 1/3)

One drop every morning, noon and evening.

#### Methylene Blue.

*Methylthionine hydrochlorium*, U. S. *Methylthionine hydrochloride*.

This purified dye-stuff occurs as a dark-green, crystalline powder with a bronze lustre. It is readily soluble in water, the solutions having a deep-blue color. It is a decided antiseptic and is occasionally used as a germicide in ophthalmic therapy. It should not be confused with *methyl violet* (q. v.).

Dunbar Roy (p. c.) uses it as a *saturated solution in water*, in *corneal ulcers* and in *mucopurulent conjunctivitis* and has had more success with it in these diseases than with any other remedy.

Melville Black (p. c.) uses a *two per cent. solution* as a *test for abrasions of the cornea and conjunctiva* and for unhealed corneal ulcers. He considers it *more effective and easier to use than fluorescein* and unlike the latter agent, it undoubtedly has some therapeutic value.

#### Methyl Blue.

(See *Pykotanin*.) Sometimes called *Methyl violet*.

#### Milk.

*Cow's milk.*

In *acute eczema of the lids*, or in any other disease of the external eye where it is undesirable to use watery solutions *warm cow's milk* is a good detergent. In *phlyctenules of the conjunctiva* or cornea, especially if associated with facial eczema, the parts should not be washed with water but with a cleansing oily emulsion. In such cases milk forms an admirable application. It is also a soothing liquid ready to hand for washing out the sac in burns of the conjunctiva from acids and other chemicals.

**Mitin.**

This is a white, neutral, soft substance like *petrolatum* (q. v.) that easily blends with most drugs used in ophthalmology. It was introduced by Jessner and is now recommended by Haas and others as a *valuable excipient for eye salves* and as a *satisfactory vehicle* for resorcin, mercurial salts, thigenol, etc.

**Monochlorophenol.***Paramonochlorophenol.*

Made from *para-aminophenol* by means of chlorine. It occurs as colorless crystals, slightly soluble in water; soluble in ether and alkaline fluids. It is a decided antiseptic and is recommended especially in *syphilitic iritis and keratitis in subconjunctival injections* of a 1 to 2 per cent. aqueous solution.

Dolganoff claims that in corneal ulcer *subconjunctival injections of parachlorophenol (one per cent. in water)* are quite as effective as mercuric cyanide or bichloride and not nearly so irritating and painful. The phenol compound really acts as an analgesic and the discomfort following the injection is small or lasts only a few minutes.

**Morphia.**

(See *Opium*.)

**Muriatic Acid.**

(See *Acid, hydrochloric*.)

**Muscarine.**

This alkaloid, from the poisonous fungus *Amanita muscaria*, has *miotie* properties, but owing to its uncertain action it is not now used in ophthalmic practice. Unlike other pupil-contractors it affects the ciliary before the iridic muscle—inducing a spasm of accommodation in advance of the miosis.

**Mydrin.**

This is a white powder, a proprietary mydriatic (Merck) composed of one part homatropine to 100 parts ephedrine in a 10 per cent. aqueous solution, and intended to produce an evanescent mydriasis mainly for ophthalmoscopic purposes. After the use of one drop Oliver (14) noticed that the pupil reaches its maximal dilatation of 4 to 7 mm. in 30 to 35 minutes, and returns to normal in four to six hours' time. The mixture is more effective as a mydriatic than either of its constituents alone.

Groenouw (45) used the following as a substitute for mydrin:

R

Ephedrin. hydrochlor.

gr. vii

Homatropin.

gr. 7/100

Aquæ dest.

3 iiss

The dilatation of the pupil begins shortly after instillation and remains at its maximum for half an hour, thus affording ample time for an ophthalmoscopic examination.

# **Mydrol.**

*Iodomethylphenylpyrazolon.*

A white, odorless, bitter powder, soluble in water and alcohol but insoluble in ether. In 5 to 10 per cent. aqueous solution it has been recommended as a *mydriatic* and *substitute for euphthalmine* (q. v.).

# **Myrrh.**

*Gum-resin myrrh.*

A resinous gum from *Commiphora Myrrha*. It contains a volatile oil, glucoside, myrrhin, etc., and acts locally as an astringent.

The *tincture* is the preparation commonly used as a local application in eye diseases, in the proportion of 1 to 5 per cent. In this, as in other spirituous combinations, it must be remembered that the *alcohol* (q. v.) plays an important part. Percy Friedenbergl (p. c.) uses the following mixture as an *astringent for conjunctival catarrh*:

R

Tinct. myrrhæ	1.00
Aquæ rosæ	6.00
Sat. sol. acid. boric.	15.00

# **Nargol.**

An argentic compound with nucleinic acid, derived from yeast. It contains about ten per cent. of metallic silver, readily dissolves in water and is said to penetrate the tissues deeply and not to irritate mucous membranes.

Nargol is considered by some observers to be quite the equal of argyrol and protargol (q. v.) as a germicide. Like those agents it is non-irritating and is used in about the same dosage (5 per cent.) for such cases as should be treated with silver salts. Some ophthalmologists prescribe it in the form of salve—5 to 10 per cent.—as a stimulant to slowly healing corneal ulcers and in the chronic forms of blepharitis. (See *Silver and its salts*.)

# **Nizin.**

*Zinc sulphanilate.*

A zinc salt of *sulphanilic acid*, recently introduced by Burroughs, Wellcome & Co. It is a neutral, white, crystalline substance; readily soluble in water. It is recommended by Sydney Stephenson in *diplobacillary conjunctivitis* and in ulcers of the cornea associated with that affection, when employed as a solution containing one to three grains to the ounce of distilled water. He regards it as an efficient substitute for the zinc chloride in common use.

**Nirvanin.**

Chemically this is a complicated oxybenzoylmethyl ester, occurring as colorless crystals readily soluble in water. It is said to be less poisonous than *orthoform*, for which it is offered as a substitute.

As a *local anesthetic* it has not met with favor in ophthalmic therapy, although it is much less poisonous than cocain, its solutions can be boiled with impunity and it is decidedly antiseptic. On the other hand, it is but feebly anesthetic and in from 1 to 4 per cent. solution is decidedly irritating to the ocular tissues.

**Novargan.***Silver proteinate.*

This silver albuminate, containing ten per cent. of the metal, is a fine, yellow powder, readily soluble in water and used, like argyrol, nargol, and largin, in those diseases of the eye where a non-irritating silver salt is required. It has about the same clinical value and is prescribed in the same dosage as protargol (q. v.) (See, also, *Silver and its salts.*)

**Novocaine.**

A complicated organic compound *introduced to supersede cocain*, especially in hypodermic injections.

It was first fully described and recommended by Braun (4). It crystallizes in small colorless needles, is soluble in its own weight of water and melts at 150 degrees C. There is no irritation from its use even in concentrated solution, and the cornea will stand the powdered drug. As the anesthesia from novocaine is comparatively brief (and for this reason is not likely when used alone to be a serious rival of other anesthetics) it is suggested that it be employed *hypodermatically with the suprarenal alkaloids*. Such a combination prolongs to a considerable extent its otherwise transient effects. The usual dosage ranges from one to ten per cent.

Gebb\* carefully studied the clinical and other actions of novocaine and noted that it does not affect the width of the pupil in the less concentrated solutions. In 5 per cent. and 10 per cent. strength (exceptionally in 3 per cent.) a slight mydriasis is noted in the human subject after ten minutes. The duration of the dilatation varies; it may be very brief or persist over an hour. The dilated pupil always reacts to light and convergence. If suprarenin is added to 1 per cent, or 2 per cent. solutions of novocaine in 1:1000 strength, a difference in pupillary width is obtained but without complete paralysis.

In the cases investigated novocaine exerted no influence on the accommodation; even after the instillation of large amounts of the 10

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\**Archiv für Augenheilk.*, May, 1906



per cent. solution, a reading test showed that the action of the ciliary muscles was not affected.

The advantages of novocaine over cocaine lie in its capacity for sterilization by boiling, in its negative action on the accommodation and, finally, in its being much less toxic. It is relatively non-irritating and the burning sensation produced does not constitute a contraindication. The same is true of the slight degree of hyperemia and mydriasis noted.

Nevertheless, novocaine, even after addition of suprarenin, is *inferior to cocain as an anesthetic for the eye*.

Wicherkiewicz (*Wochenschrift für Therapie und Hygiene des Auges*, Feb. 14, 1907) has made some important observations of the use of *novocaine*. The drug was used in 1 to 2 per cent. solution and the author noticed that novocaine anesthesia is somewhat slighter, but comes on as quickly and lasts as long as cocain anesthesia. It has no influence on the pupil or accommodation, and does not reduce tension. On the other hand, it seems to delay the healing of the wound in cataract extraction. Novocaine is specially suited for the infiltration method when the tissues are inflamed. *Enucleation of a tender eyeball* can be carried out painlessly. For this purpose he recommends the following solution:

R	
Novocain.	0.125
Suprarenin.	0.00016
Sodii chlorid.	0.225
Aquæ dest.	25.

#### Novorenal.

A term applied to a *solution of novocain and adrenalin*, sterilized and sold ready for use in sealed ampullæ. The composition of the solution varies according to the particular purpose for which it is used, but the solvent in most instances is physiological salt solution, and it evidently belongs to the same class as *capren*, *codrenine*, etc.

#### Oleogen.

A clear, yellow, oily ointment-base, containing *oleic acid* and yellow *petroleum oil*, with a proportion of ammonia. Sp. gr. 0.91. It is miscible with chloroform in all proportions. This mixture of oleic acid and petroleum oil is not subjected to the action of oxygen, and so differs from the patented vasogen.

Like *vasogen* (q. v.) and *petrogen* (q. v.) there are marketed a number of useful compounds with oleogen. Of interest to the ophthalmologist is *oleogen ichthyol*—a 10 per cent. mixture; *oleogen iodi*—a 5 and 10 per cent. iodine mixture. These liquid, oleogen compounds are rapidly absorbed when applied by inunction to the skin or

mucous membrane. They are useful in *chronic conjunctivitis*, *blepharitis* and *corneal opacities*, especially when applied by means of massage.

#### **Oleum Homatropinae.**

A 2 per cent. solution in castor oil, dissolved by heat.

*Oleum homatropine cum cocaina*, P. Br., contains in addition two per cent. of cocaine. The Moorefield's *Pharmacopeia* has a formula with 10 grains of each to the ounce, practically the same strength. These oily solutions when dropped into the eye are not washed out by the tears. Homatropine oil is recommended in preference to atropine in estimating errors of refraction; the inconvenience of the mydriasis may be partially overcome by *eserine*.

#### **Oleo-balsamic Mixture.**

This preparation, official in the German Pharmacopeia (q. v.), is miscible in water. Either alone or as an adjuvant it makes soothing collyria in hyperemia of the conjunctiva and in the milder forms of conjunctivitis. Ohlemann, for this purposes advises:

℞

Mist. oleo-balsamicæ

1:5 (gr. xxiii)

Sodii salicylatis

3.0 (gr. xlv)

Aquæ dest.

150.0 (℥ iv ⅓ vi)

#### **Oil of Arachis.**

*Oleum arachis.*

A fixed oil expressed from the seeds of *Arachis hypogæa*, the earth-nut, ground-nut or *pea-nut*. It closely *resembles olive oil* and is used, like it, in ophthalmology as a vehicle.

#### **Olive Oil.**

*Oleum olivæ. Sweet oil.*

The fixed oil expressed from ripe fruit of *Olea europæa*. It is a pale, yellow, oily liquid with a neutral reaction, a bland taste and a faint, agreeable odor. Only the purest oil should be used in pharmacy.

Although this oil is among the commonest oleaginous remedies we have and has long been used in medicine it is not much prescribed in ophthalmic surgery. As an oleate we find it in "cold cream" and it is recommended as a *solvent for atropia, eserine and other alkaloids*, although it is questionable whether almond oil or the more viscid castor oil may not be its superior for that purpose. It makes a good menstrum for some tar ointments and may be used as an antidote (applied with a brush) to strong alkalies and lime in burns of the eye from these escharotics.

#### **Opium.**

*Meconium. Succus thebaicus.*

The dried juice from the unripe capsules of the opium poppy—

*Papaver somniferum*—yielding not less than 9 per cent. of crystallized morphia. The soluble preparations of opium are *incompatible with* alkalies, copper salts, tannin, mercuric bichloride, and silver nitrate.

Almost every known preparation of this drug has been used in the treatment of eye diseases but aqua opii. (P. G.), laudanum (tr. opii), tincture of deodorized opium, solution of morphia and ext. opii form the common topical remedies. Owing to its action as a miotic when given in full doses internally it has been prescribed for the pain and insomnia accompanying glaucomatous attacks. So far as I can learn the application of opiates directly to the eye tissues arose from their well known general action. Even von Graefe often prescribed an eye wash composed of equal parts of water and laudanum for the relief of eye pains. However, although dionin (q. v.) and other remedies derived from opium are among the most useful local analgesics we have there is probably no ground for the assumption that opium is a local anesthetic, as we know that it acts through the great nerve centers and not at all, or but feebly, on filamentary endings. Experience has also proven the futility of depending upon such supposed soothing or pain-destroying local applications and they are rarely employed, except as part of an occasional collyrium or ointment, in both of which (owing to their limited absorption) I believe them to be practically inert.

Examples of such employment will be found in Scott's mixture (q. v.), and in a domestic prescription of Schmidt-Rimpler for the relief of the burning sensations and pain of conjunctival hyperemia:

R

Zinc. sulphatis	0.5 (gr. vii)
Tinct. opii	1.0 (m xvi)
Aquæ feniculi	50.0 (f $\bar{3}$ i 5 vss)
Aquæ dest.	100.0 (f $\bar{3}$ iiii)

Both prescriptions act as promptly with the opiate omitted.

In deprecating the employment of tinctures of opium as topical remedies one must not forget the mildly antiseptic and stimulating effects of the alcohol they contain. Thus, Ohlemann advises one part of tincture of opium to five parts of distilled water as a stimulating collyrium in partially healed ulcers. The German pharmacopeial *tinctura opii crocata*, prescribed as a local analgesic in eyewaters, corresponds to our *vinum opii*, the so-called Sydenham's laudanum. It has about the same strength as the ordinary tincture of opium.

Lawson (*Text-book*, p. 538) suggests the following as a *soothing application to the conjunctivæ*:

℞

Ext. opii. liq.	fl. ʒi
Acid. hydrocyanici dil.	m. xxx
Aquæ dest. ad	fl. ʒviii

The following mixture is recommended by Theobald (*Text-book*, p. 512):

℞

Ext. opii.	gr. x (0.60),
Acid. boracic.	gr. xl (2.70),
Aquæ dest.	fl. ʒiv (60.00).

He believes it to be *valuable in any painful condition of the eye*, especially in traumatic lesions, in keratitis, iritis, glaucoma, acute inflammation of the lacrimal sac, lid abscess, panophthalmitis, cellulitis of the orbit, etc. It is also *useful in asthenopia* in miliary choroido-retinitis, dependent upon strain of accommodation, and in the choroido-retinitis of high myopia. It may be given a *poultice-like action* by covering the pad on which it is applied with oiled-silk or oiled-muslin; or it can be applied hot if found more soothing.

#### Orthoform.

A white, colorless, crystalline powder, slightly soluble in water, more so in alcohol and ether. Orthoform is a complicated, chemical organic compound with anesthetic, anodyne and antiseptic qualities. One of its ophthalmic uses is as a 10 per cent. mixture with starch in burns of the face and eyelids.

The *Bulletin Générale de Therapeutique* gives the following formula for making modified copper sulphate pencils for trachoma and other forms of granular lids into which *orthoform* also enters:

℞

Cupri sulph. pulv.	10.00
Orthoform.	5.00
Holocain. hydrochlor.	
Tragacanth.	āā 4.0
Aquæ dest. q. s.	

Mix thoroughly and roll into pencils of convenient size. Although they contain 50 per cent. of copper sulphate they cause no pain when applied to the granular surface.

#### Osmosine.

(See *Cadmium salicylate*.)

#### Pagenstecher's Ointment.

This title is loosely applied to all salves made with the yellow oxide of mercury (q. v.). Originally Pagenstecher prescribed it as a

ten per cent. mixture, but this preparation proving too irritating the amount of oxide was gradually reduced. (See *Mercury, Yellow oxide of.*) It is at present pretty generally acknowledged that, properly made, ointments of yellow oxide yield their best results in proportions of 1:1,000 to 1:250. In Germany it is still used in strengths of two to four per cent. Talbott R. Chambers (p. c.) advises the following plan for the effective mixing of this important salve:

"The improved ointment is made as the U. S. P. directs, except that *the precipitate is not allowed to dry before mixing with the grease.* Dissolve 25 grammes of corrosive chloride in 250 grammes of warm, distilled water. Dissolve 10 grammes of sodium hydrate in 250 grammes of cold distilled water. Slowly mix these two solutions and allow the resultant to stand for about an hour at a temperature of about 30° C., agitating frequently. Decant the supernatant liquid from the precipitate. Wash the precipitate with distilled water until free from soda.

"The precipitate, *a moist magma*, is placed on a cloth strainer and allowed to drain. *Before it has dried* it is incorporated with equal parts anhydrous wool fat. This in turn is mixed with two parts of white vaseline.

"If our druggists will keep this stock ointment on hand, of which four grains roughly represent one grain of yellow oxide of mercury, they may in a minute prepare any strength of ointment desired and the result will be constant—a *smooth, uniform, elegant and effective ointment, which has the added virtue of being painless.* By the old method of simply mixing the dried oxide with vaselin, *it takes prolonged rubbing to obtain a smooth result* which, after all, under a low power shows its granular condition. Theoretically, the ointment freed of its granular condition should be less painful than where the granules are present. Practically, I am able to record that individuals who found the old formula too painful register no objection to the improved style."

J. A. Andrews (p. c.) also calls attention to the fact that *unless properly incorporated with its excipient this valuable mixture may do harm rather than good*, and says it is worth while to take pains in the preparation of this ointment to ensure the best results, for patients will certainly object to its application if, as commonly prepared, *it occasions much smarting.*

Under the trade name of "Marginol" the Manhattan Eye Salve Company markets in *small, collapsible tubes* the following ointment, which I find very satisfactory because of the *intimate mixture of its compounds.* Each tube contains:

℞

Hydrarg ox. flav.	gr. j,
Petrolati,	℥ii.

According to C. Barck (p. c.) an excellent and *stable yellow ointment* is obtained by this simple formula:

℞

Hydrarg. oxidi flavi	0.30
Ungt. acidi borici, U. S.	15.00

To be thoroughly mixed.

The following formulæ will all be found useful in various forms of blepharitis, for applying to the eyeball by way of the conjunctival sac, in phlyctenules of the conjunctiva, chronic conjunctivitis and other conditions:

℞

Hydrarg. ox. flav.	0.05 (gr. 2/3)
Ungt. aquæ rosæ	5.00 (℥i ℥ i)

℞

Hydrarg. ox. flav.	02 (gr. iii)
Petrolati	20. (℥v)

℞

Hydrarg. ox. flav.	0.3 (gr. ivss)
Lanolini	6.0 (℥ iss)
Petrolati	3.0 (gr. xlv)

#### Paraffin.

*Paraffin wax. Ceresin.*

A varying mixture of members of the paraffin series of hydrocarbons, solidifying at different temperatures and distinguished as *liquid*, *soft*, *medium* or *firm*, and *hard* at ordinary house temperatures. Hard paraffin is a white, odorless mass meeting at 77° C.

In commerce *liquid paraffin* is known under various names, such as *adepsine oil*, *chrisimaline*, *saxol*, *oleum Deelinæ*, *atoleine* and *paroleine*.

Paraffin ointment, mostly used in Germany, is a firm mass employed as a base for remedies and in making other salves. It is a white, neutral, odorless compound made by melting one part of solid in four parts of liquid paraffin. Olive oil, almond oil or vaselin in varying proportions, should be added to it when a softer excipient is needed.

#### Paraiodophenol.

*Phenol iodide. Paraphenol iodide. C<sub>6</sub>H<sub>4</sub>OHI.*

Colorless or reddish crystals with characteristic odor.



It may be applied pure or diluted with glycerine as a *cauterant* for corneal ulcers. See *Phenol iodized*.

**Paranephryn.**

Trade name (Merck) of a substance obtained from the suprarenal glands without the aid of acids or alkalies. It is marketed in 1:1000 sterile solution with 0.60 per cent. of sodium chloride. The bottles contain 10 cc. (150 minims) of the solution.

This is one of the most reliable of the *adrenal preparations* and, like adrenaline (q. v.) and other agents of the kind, is used alone or in conjunction with local anesthetics in ophthalmic practice.

**Parenole.**

The name given by Humphrey\* to a *new series of ointment bases*, which have a salve-like consistency and possess the property of taking up more than their weight of water. They are also miscible with any of the fats. A *fluid parenole* is also made, which constitutes a neutral liniment and may be used as a lubricant, as a vehicle and for subcutaneous injections. They ought to be valuable in ocular therapy.

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\**Pharmaceutical Jour.*, 623, 1906.

## CHAPTER XXVIII.

### REMEDIAL AGENTS EMPLOYED IN THE LOCAL TREATMENT OF EYE DISEASES—Continued.

*Perhydrol—Peronin—Petrogen—Petrolatum—Phenol—Phenol Iodized—Phenosallyl—Physostigma—Physostigmine—Pilocarpine—Plantago—Plasma—Pollantin—Potassium Fluoresceinate—Potassium Chlorate—Potassium Chloride—Potassium Iodide—Potassium Permanganate—Protargol—Pyoktanin—Pyoktanin, Yellow—Quinine—Quinosol—Radium—Resorcin—Roentgen Rays—Romershausen's Eyewater—Rotoin—Rubidium Iodide—Saffron—Salicylic Acid—Salol—Sambucus—Sanofom—Sassafras—Sattler's Solution—Schleich's Salt—Sclarea—Scopolamine—Scott's Mixture—Silver Acetate.*

#### **Pelletierine.**

An alkaloid, or mixture of alkaloids, from the pommegranate, *Punica granatum*, stem, root and bark. A number of salts of this agent are known but none of them, so far as I am aware, is used in ophthalmic therapy excepting the hydrobromide. It is a brownish, viscid liquid and in doses of from 5 to 8 grains has been recommended in pareses of the ocular muscles with good results.

#### **Perhydrol.**

*Hydrogen peroxide.* Merck.

This is a pure solution of *hydrogen peroxide* (q. v.) in water, containing 30 per cent. by weight and 100 per cent. by volume of  $H_2O_2$ . It mixes in all proportions with water and is a *powerful antiseptic, deodorant, styptic and germicide*. As a collyrium-germicide it is employed as 0.30 per cent. solution in distilled water. It is strongly recommended as an improvement on the ordinary 3 per cent. solution of peroxide of hydrogen.

#### **Peronin.**

This is a benzyl-morphine hydrochloride and is chemically and clinically *related to dionin*, which is an ethyl-morphine hydrochloride. It is a white compound, slightly soluble in water and dilute alcohol, and was originally used as a substitute for morphia internally in increased doses. It was first employed by Wolfberg\* who, on introducing a two per cent. solution into the eye, noticed a marked and almost instantaneous chemosis of the lids and conjunctiva. He shortly

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\*Wolfberg. *Wochenschr. f. Therapie des Auges.* III. 1899.

afterwards abandoned his experiments with peronin *in favor of the more soluble and similar dionin*, at that date the recently discovered (Mehring) morphia compound.

#### Petrogen.

This is a proprietary vehicle for *iodine, phenol, camphor, iodoform* and other active remedies used in ophthalmology and general surgery. It resembles *vasogen* (q. v.) and in both *liquid* and *semi-solid* form is employed for the same purpose as that menstruum. It is marketed alone and in combination with the remedies just mentioned in various proportions from 5 to 50 per cent. In the liquid condition it readily dissolves *iodine, mercury compounds, carbolic acid, ichthyol*, etc.

#### Petrol.

##### *Motor spirit.*

*Pétrole* is the name given in France to our *naphtha* or *gasoline*, and like it is composed of the (heavier) hydrocarbons *from crude petroleum* that boil below 50° C. (122° F.). It is on occasions used as a solvent for remedies employed in ocular therapeutics.

Ferentinos\* asserts that *biniodide of mercury dissolved in petrol* reaches the tissues more readily than an aqueous solution, and that the vehicle itself is aseptic. He has used it in many external diseases of the eye, and regards it as a valuable aid to other remedies.

His formula is:

R

Hydrarg. biniodidi

I.00

Petrol

1000.00

One part to be mixed with three of liquid vaseline.

#### Petrolatum.

##### *Petrolatum U. S. Petrolatum spissum.*

This hydrocarbon differs very little from *soft paraffin* (q. v.) and closely resembles in all its characters common *vaseline* (q. v.). It is an unctuous mass of yellowish color; odorless and tasteless. It gives off, when heated, a faint petroleum smell. It melts at 48° C. (118° F.) It is insoluble in water and alcohol but is readily dissolved by ether and the fixed oils.

A white variety—*petrolatum album*—is official in the U. S. P., corresponding to the commercial article *cosmoline*.

*White vaseline* is ordinary vaseline filtered through animal char-

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\*Die Ophthal Klinik, Sept. 20, 1907

coal, and in various countries where it is similarly treated, is known as *soft paraffin*, *adepsine*, *chrisma*, *saxoline*, *geoline*, and *salvo petrolia*.

Its common use is an excipient for ointments. It should be prescribed instead of vaseline.

See, also, *vasogen* and *petrogen*.

### Phenol.

*Carbolic Acid. Phenyl hydrate. Phenic acid. Phenylic acid. Phenic alcohol. Benzophenol. C<sub>6</sub>H<sub>5</sub>OH..*

A coal-tar distillate—hydroxybenzene—contains about 96 per cent. of pure phenol. The latter is a colorless, crystalline, acicular solid with a faint aromatic odor. It is very deliquescent and a small quantity of water transforms it into an oily liquid that reddens if the phenol contain the least impurity. When much diluted it has a sweetish and not unpleasant taste. It is readily soluble also in glycerine and olive oil. It is a powerful poison and forms salts or compounds with many bases. Some of these carbolates are employed in ocular therapeutics.

Carbolic acid is *incompatible with camphor*, lead acetate, menthol, resorcin, thymol, collodion and several other agents employed in ocular therapy.

This is one of the most effective germicides in the pharmacopeia but it has a very limited application to the eye proper owing to its extremely irritating properties. I regard a 95 per cent. mixture with glycerine as a *good cautery for non-serpiginous ulcers of the cornea*. After staining (see Fluoresceine), irrigating and anesthetizing the globe the diseased area should be thoroughly probed with the point of a wooden tooth-pick soaked (not merely dipped) in the solution, excessive fluid being removed from the tooth-pick with blotting paper. This procedure may be repeated several times if necessary. Inasmuch as the phenol whitens the ulcer-area it is easy to regulate the application. Success depends upon using as little as possible of the cauterant and tattooing it well into the infected spot. There is little or no destruction of true corneal substance by the carbolic acid and, consequently, a minimum amount of scarring.

Although now rarely used as an eyewater or on dressings intended for the eye, it is employed for sterilizing instruments, sutures, etc., intended to be used in operative work. I am in the habit of immersing cutting instruments for disinfection in 80 to 90 per cent. phenol in glycerin for 10 to 15 minutes in preference to boiling them. They are afterwards transferred to sterile water or alcohol which readily removes the phenol and keeps them free of dust and germs before and while they are in use.

Although irritating as a collyrium or anti-bacterial eye lotion it is sometimes prescribed in 1-1,000 to 200 watery solution.

In *ulcers of the cornea and in infective conjunctivitis* Perry Fulkerson (p. c.) uses the following *collyrium*, to be dropped into the eye every two or three hours :

R

Acidi, borici.	gr. xxx
Cocain. muriatis	gr. x
Acid. carbolic.	gr. viii
Aquæ dest. ad	fl. ʒiv

### Phenol, Iodized.

*Iodized carbolic acid. Solution of iodine in glycerine-carbolic acid.*

This is one of the preparations of the Nat. Form. which directs that it be made from iodine 20 parts, phenol 60 parts and glycerine 20 parts. *Applied pure to corneal ulcers* it is one of the most effective cauterants and germicides we possess. I believe it to be in that respect even better than pure tincture of iodine or pure phenol used alone. Of course, it is to be carefully rubbed into the stained, cleansed and cocainized cornea by means of a pointed tooth-pick or wooden match, soaked in the fluid. See, also, *Paraiodophenol*.

### Phenosalyl.

A powerful *antiseptic mixture* made by heating together 9 parts of *carbolic acid*, 1 part of *salicylic acid* and 0.10 parts of *menthol*. It is recommended as a collyrium in 0.20 to 0.40 per cent. watery solution, especially for various forms of *conjunctivitis*.

### Physostigma.

*Calabar bean. Ordeal nut. Chop nut. Split nut.*

Seed of *physostigma venenosum* and the source of *eserine* (physostigmine) and another poisonous alkaloid resembling it in clinical character—*cseridine*—said to be even more powerful than the former. A 1:15 glycerine solution of the alcoholic extract of calabar bean is preferred by some observers to any of the miotic alkaloidal solutions.

### Physostigmine.

(See *Eserine*.)

### Pilocarpine.

This important alkaloid exists, with several others, chiefly in the dried leaflets of *Pilocarpus microphyllus*, the Jaborandi shrub of Brazil, in which it is found to the extent of one per cent. The pure alkaloid is a colorless, syrupy fluid, soluble in water. It is not used in ocular therapy, although the official tincture, solid and fluid extracts of jaborandi occasionally are. The best known salts, usually white

crystals soluble in water, are employed in about the same dose as topical agents, viz.:  $\frac{1}{2}$  to 10 per cent. These are the borate, hydrobromide, hydrochloride, nitrate, salicylate, sulphate, tannate and valerate.

Pilocarpine is *incompatible with* silver nitrate, corrosive sublimate, tannin, the permanganates, alkalies and the iodides.

The hydrochloride is extensively used in from a half to four per cent. solutions, as a miotic. It is, clinically, a somewhat milder remedy than eserine (q. v.). It is employed chiefly in glaucoma, corneal ulcer and for all purposes where a weak pupil-contractor is desired. Both the jaborandi preparations and all the pilocarpine salts are poisons and care must be observed in exhibiting them hypodermically or for subconjunctival use. The value of pilocarpine as a sialogogue and diaphoretic in the general treatment of intraocular diseases by means of sweat baths or the iodides has been several times dwelt upon. In this connection it should be given by hypodermic injection in doses of 1-12 to  $\frac{1}{4}$  grain. (See Baths and Potassium iodide.)

The following formula makes a good, average prescription that does not easily decompose and that may be used three times daily in cases where a weak miotic is needed or where eserine is not well borne:

R

Pilocarpin. hydrochlor.	gr. iii (gm. 0.2 )
Sodii chlor.	gr. 1/6 (gm. 0.01)
Sol. hydrarg. bichlor. 1-5,000 fl.	℥iiss (c.c. 10.0 )

Lilienfeld has shown that impure pilocarpin may contain *jaborin*, an isomeric form of pilocarpin which is really a mydriatic. As the presence of this drug neutralizes to some extent the clinical value of any pilocarpin preparation into which it enters, only those drugs made by the best pharmacists should be employed.

#### **Plantago.**

*Plantain. Ribgrass. Ripplegrass. Ribwort.*

The whole plant of *Plantago major* is used in medicine. It contains *tannin*, like so many herbs employed in ophthalmic therapeutics, and is prescribed as *compresses* and *eye lotions* in the form of the *aqueous extract or infusion in subacute and chronic forms of conjunctivitis*. It is also made into "tea" for the same purpose, like chamomile (q. v.), Clary Sage (q. v.) and similar astringent, herbaceous remedies.

#### **Plasma.**

(See *Artificial blood serum*.)



**Pollantin.**

*Dunbar's serum.*

An antitoxic serum from horses treated with pollen toxin derived from the *rag weed* (*Wild Tansy*), *Ambrosia artemisiifolia*. It is a clear, yellowish fluid, smelling of its preservative, 0.25 per cent. of phenol. It soon decomposes if exposed to air. It is used undiluted (or diluted one-half to one-fourth) as a daily collyrium in eye affections.

This remedy is also supplied in *dry form as snuff*, the *flowers of the "Golden-rod"* having been used. A number of favorable results from its use have been reported in the eye complications of "hay fever."

George S. Derby (p. c.) has found this agent of considerable value in *vernal catarrh*. It allays the irritation of the disease, although it has no curative effect. E. Gruening and others have used the same remedy and speak highly of it.

**Potassium Fluoresceinate.**

(See *Fluorescein*.)

**Potassium Chlorate.**

*Kalium chloricum*, P. G.  $\text{KClO}_3$ .

Chlorate of potash is found in short, shiny prisms or colorless plates. It is neutral and odorless with a cooling, saline taste. It is permanent in air but decomposes—sometimes with explosive violence—when mixed with some organic matters, such as sugar, cork dust, tannic acid or with easily oxidizable substances like sulphur or phosphorus.

Although a very old remedy this salt has had comparatively little use in ophthalmic therapy. It is advised by Koster (10) in all forms of conjunctivitis, with or without ulcers at the corneal margin. The drug acts as an astringent and mild antiseptic. Bacteriological investigations show that cultures of various kinds of pathogenic microbes from the mucous secretions of diseased eyes, which developed rapidly on agar-agar, do not grow when a 3 per cent. solution of chlorate of potash was added.

**Potassium Chloride.**

*Kalium chloratum vel chloridum. Sal digestivum Sylvii.*

This salt forms a double chloride with magnesium in *carnallite* and is obtained from this mineral in large quantities. It is found in drug stores as whitish, odorless cubes or prisms with the taste of common salt. It freely dissolves in water; sparingly in alcohol.

Chloride of potassium is rarely used in ocular therapy but is of interest to readers of German literature because of the difficulty, partly arising from the confusion of pharmacopeial terminology and partly

from the improper use of terms, in determining whether the writer is speaking of potassium chloride, potassium chlorate, potassium perchlorate ( $\text{KClO}_4$ ), or chlorinated potassa.

### Potassium Iodide.

#### *KI. Iodide of potassium.*

Occurs in small, colorless, generally translucent, neutral or alkaline cubes. It has a faint odor of iodine and a salty, bitterish taste. It is freely soluble in water and glycerine; less soluble in alcohol.

This important drug has held its own in spite of the many objections urged against its prolonged use, despite the symptoms of iodism set up in persons susceptible to its poisonous action and notwithstanding the frequent substitution of other remedies for it. Although I have made trial of many drugs, iodonucleoid, iodalbumin, sodium iodide, strontium iodide, mixtures of other iodides, etc., said to exhibit superior virtues yet, on the whole, I have found no iodine preparations equal to this potassic salt for the internal treatment of cases properly calling for its employment. When the full strength of the salt is desired (as it generally is in ocular therapeutics) large does may, in nineteen instances out of twenty, be given with comfort and safety for several weeks at a time. My plan is that recommended by Baker (41). One begins with a fair-sized dose, say 100 minims three times daily, of the following solution:

R

Potass. iodidi

℥iii

Aquæ dest. ad

℥l. ℥vi.

The patient takes the dose with a large quantity—a pint and a half—of water, between meals. He may swallow the dose in a small quantity of water and take his time about drinking the remainder of the diluent; if he can drink 30 ounces of the liquid, all the better. The bowels should be kept open and if the skin can be made to act freely by a bi-weekly Turkish or pilocarpine bath (q. v.), the less the danger of iodism. Of course, the kidneys should be competent and there should be no contraindication to the use of iodides in general. The daily dose can generally be increased 20 to 50 minims, using a minim measure for the purpose, until the patient is taking 300 or 400 grains of the iodide daily. At the end of 2 to 4 weeks I intermit the treatment a week or two, as seems desirable. Following this plan I rarely have any serious trouble from intestinal irritation, coryza, dermal eruptions or other toxic symptoms.

As Baker points out, it sometimes happens that large doses will be tolerated when small ones are badly taken. Large doses should not be limited to specific cases, but are indicated in most in-

stances of optic neuritis, ocular paralysis, choroiditis, serous iritis, relapsing iritis, cyclitis, and in interstitial keratitis. They are contra-indicated in gray atrophy of the optic nerve and in most cases of post-neuritic atrophy. Albuminuria is also a contra-indication and the iodide should be cautiously given to children, who do not take it kindly.

It must be remembered that potassic iodide, in common with other iodides, is also used *locally*, as *collyrium and ointment*. If they have any action at all it is probably the result of their counter-irritant or stimulating powers. Schmit-Rimpler advises in certain forms of vitreous opacities the instillation of these eye drops:

℞

Potass. iodidi	0.1 grm. (gr. iss)
Aquæ dest.	10.0 c.c. (fʒiiss)

In both instances it is often employed to keep other iodides, biniodide of mercury (q. v.) for example, from decomposition and in solution.

Examples of local applications are:

℞

Potass. iodidi	0.1 grm. (gr. iss)
Sodii bicarbonatis	0.05 grm. (gr. 7-10)
Petrolati	3.0 grm. (gr. xlv).

Ft. ungt.

℞

Potass. iodidi	1.0 grm. (gr. xv)
Aquæ dest.	10.0 c.c. (fʒiiss)

Both the foregoing are used as stimulating absorbents in corneal opacities.

E. W. Carpenter (p. c.) has used this remedy in *subconjunctival injection of four grains to the ounce of distilled water* and found it acted very well in *severe iridocyclitis*. He, also, reports that a *one per cent. solution*, to be used by the patient in the same way as dionin, acts very satisfactorily.

#### Potassium Permanganate.

*Kalium permanganicum*. P. G.  $\text{KMnO}_4$ .

Permanganate of potash occurs as dark-purple, or nearly black, slender prisms with a metallic lustre. They are odorless but have a sweet, astringent taste. In the presence of most organic matter it is a powerful oxidizing agent. It is freely soluble in water, making an inky solution.

At one time this was a favorite antiseptic in watery solutions of 1 to 2,000 to 500, both as a collyrium and for the treatment of lachrymal diseases, but in recent years it has fallen into general dis-

use. Possibly its disagreeable and destructive staining qualities and the discovery of numerous other effective germicides have had something to do with this result. In the strength of 1-3,000, three times daily, Kalt (61) recommends it for large flushings of the conjunctival sac in purulent conjunctivitis and corneal ulcer.

J. A. Lippincott (p. c.) employs a 1-2000 solution in all forms of *conjunctivitis associated with the formation of pus*.

The best strength for *injecting the sac and nasal duct* in dacryocystitis is one per cent.

It must not be forgotten that permanganate sprays and douches of the nasal passages are highly recommended as one of the preliminaries to cataract and other major operations on the eye.

*Condy's fluid*, occasionally used for disinfection of the hands and the sterilizing of instruments, is a solution of sulphate and permanganate of aluminum.

#### **Protargol.**

##### *Protargolum.*

A compound of albumen and silver, appearing as a yellowish powder with a slightly metallic taste, soluble in its own weight of water. The solutions are decidedly brown, are fairly permanent but ought to be protected from light. It is a mild bactericide, is non-irritant and, clinically, closely resembles argyrol.

On the whole, this argentic compound has proved to be one of the most popular of the substitutes for silver nitrate in ophthalmic therapeutics. In gonorrheal ophthalmia—infantile and adult—and in all the milder forms of conjunctival infection it has been praised by numerous observers. For example, Kramer found, in one hundred cases where the Credé method was used, that inflammatory reaction occurred ninety-six times; more than once it was followed by profuse secretion which persisted for several days. In 80 per cent. of the cases there was increased secretion; in 50 per cent. it disappeared after a day and in 4 per cent. it lasted until the fourth day. There was *no reaction after 25 per cent. protargol*, while protection seemed as perfect as with 2 per cent. silver nitrate.

Calvin R. Elwood (p. c.) at first found this drug in 5, 10, or 15 per cent solutions so irritating that he abandoned its use. For the past two years it has been his custom to have a 50 per cent. solution made up, without any trituration, and placed in an ice-box for twenty-four hours. At the end of this time a complete solution is formed which has been very serviceable to him as a conjunctival application and very seldom causes any irritation.

A. D. McConachie (p. c.) prefers, *when prescribing protargol to*

use himself, 1 per cent silver nitrate, with 10 per cent. solution of protargol to be used at home every three or four hours. He precedes both the office and home treatment by irrigation with normal salt solution or 1-8000 of sublimate.

Since the appearance of argyrol, argentamine and other organic silver compounds the popularity of protargol seems to be on the wane. Probably it is quite as effective, or ineffective, as silver vitelline in gonorrheal ophthalmia and may be equal to it in the same dosage (5 to 20 per cent.), or 20 to 50 per cent., in the treatment of the bacterial conjunctivitis of corneal infections. (See *Silver Salts* and *Argyrol*!).

#### **Protonuclein.**

Reid Hunt and A. Siedell\* thus pay their respects to this *proprietary article*, occasionally used in eye affections. The remarks also aptly apply to a number of other agents mentioned in these pages whose owners are apparently undecided whether to seek newspaper notoriety or to attempt to build up a reputation on merit only:

"Protonuclein is a diluted thyroid preparation; samples examined by us, chemically and physiologically, were found to contain the equivalent of 10 per cent. of thyroid containing 0.1 per cent. iodine. (The actual amount of thyroid may be greater or less, as we do not know the percentage of iodine in the thyroid used; but the mixture contained 0.01 per cent. iodine and has one-tenth the physiologic activity of a thyroid preparation containing 0.1 per cent. iodine.) The dose recommended on the bottle is six to twelve grains every three or four hours; this represents six-tenths to one and one-fifth grains of many commercial thyroid powders. The presence of this thyroid is as skillfully concealed as it is in the case of 'Rengo' or 'Marmola'; yet the amount in a dose does not differ materially in the three preparations. Protonuclein is stated to be a 'Tissue-Builder,' 'Resistant to Toxic Influences,' is indicated in all conditions when the organism is below the normal standard.' 'Special conditions: neurasthenia, exhaustion, wasting diseases, anemia, marasmus, malaria, asthenia and as a general antitoxic agent.' It is stated to be 'a perfectly harmless antitoxin, tissue-builder, blood-purifier and digestant;' it 'represents the active principles of life.' Is more claimed for any 'patent medicine' advertised in the daily papers? Yet this is one of the many proprietary preparations the advertisements of which fill the pages of the lower class of medical journals. It must seem to any thinking physician extraordinary advice to recommend the administration of a preparation containing thyroid, the most powerful tissue-destroying

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\**Jour. Am. Med. Ass'n*, Oct. 24, 1908.

drug known, to patients suffering from typhoid or phthisis—conditions in which the physician is supposed to be exerting every effort to build up the tissues. However diluted the thyroid may be and with whatever other ‘active principles of life’ (!) it may be mixed, no conscientious physician would care to use it unknowingly.”

“*Protonuclein Special*” recommended chiefly for local use or internally in half the dose of the ordinary protonuclein is stated to “represent the pure nuclein and nuclealbumen unmixed with milk sugar.” It contains twice as much thyroid as the ordinary powder. Like arbolum, etc., it is stated to be “perfectly harmless.”

G. C. Savage (p. c.) has used this remedy as a *dusting powder to the eye and conjunctival sac in both conjunctival and corneal phlyctenules* and believes it to be of particular value.

### **Pyoktanin.**

*Blue pyoktanin. Methyl violet.*

This is one of the numerous aniline dyes that have been used in medicine. It is a blue, crystalline powder, soluble in both water and alcohol and forming with them intensely blue-violet solutions.

Apart from its value as a stain in detecting corneal ulcers and abrasions, I have not found this agent in any of its usual doses (1-100 to 5,000) of particular use in ocular therapy, although Stilling (44) and others have recommended it in various infections of the conjunctiva and cornea—especially in corneal ulcer.

Arning\* recommends in the *marginal eczema of children* a *pyoktanin-benzoin varnish* prepared by dissolving the required amount of pyoktanin in tincture of benzoin. This procedure is best carried out in an evaporating basin, some of the alcohol being allowed to evaporate so as to obtain a somewhat thicker varnish. This varnish has the advantage of being easy to apply to the edge of the lids by means of a suitable brush; it dries rapidly and adheres firmly. In case a little of the varnish is accidentally allowed to enter the conjunctival sac, it causes a little burning, but does no harm, for pyoktanin is not irritant to the conjunctiva. If preferred, a *thick watery solution of pyoktanin* may be used; this also adheres like a varnish.

Wickerkiewicz gives pyoktanin the preference to other remedies in such affections of the eye as *gonorrhea of the lacrymal sac*, cellulitis of the orbit, and empyema of the cavities that adjoin the orbit.

Pyoktanin has been found very efficacious in corneal ulcer in *combination with dionin*.

Merck furnishes both blue and yellow pyoktanin in the form of

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\**Medizinische Klinik*, 1906, No. 4.



large as well as small pencils, fixed in handles and clasps, for their convenient application to ulcers, sinuses, etc.

In *chronic mucopurulent infections of the lachrymal sac* H. V. Würdemann (p. c.) employs the following mixture:

℞	
Acid. borici	0.60
Sod. chlor.	0.20
Zinci. chlor.	0.06
Pyoktanin. (blue)	0.03
Aquæ dest.	30.00

J. G. Dorsey, (p. c.) uses the following mixture as a *collyrium* in *infections and abrasions of the cornea* and as an injection into the lachrymal sac in cases of purulent dacryocystitis:

℞	
"Methyl violet"	gr. ss
Aquæ dest.	fl. ʒii

# Pyoktanin, Yellow.

## Apyonine.

*Yellow pyoktanin* seems to have had as few constant friends as the blue variety, although it, too, has been put forward as a valuable ocular antiseptic, to be employed in the same strength as blue pyoktanin. In the form of pencils it has been favorably spoken of as a germicide when directly applied to *ulcer of the cornea* and to the lids in the follicular form of *trachoma*.

# Pyraloxin.

## Pyrogallol oxidatum. Acidum pyrogallicum oxidatum.

Pyrogallol oxidized by air in the presence of ammonia. A brown powder, stable in air, soluble in water, especially on warming.

It was introduced into therapeutics by Unna, who has recommended it for *chronic conjunctivitis* with ciliary blepharitis. He prescribes the following solution for this purpose:

℞	
Pyraloxini	0.01—0.05 grm. (gr. 1-6—5-6)
Aquæ boracis (Aust. Ph.)	
Aquæ fœniculi ʒā	5 grm. (gr. 75)

By the frequent use of these drops Unna has been able to effect a cure of conjunctivitis in cases which had been given up as incurable.

# Quinine.

## Quinina. Chininum. Quinia.

This well-known alkaloid occurs as a white, flaky powder, with no odor, but a persistent, bitter taste. It is sparingly soluble (1-1,750)

in water; more freely in alcohol and glycerine. The best salt of quinine for ophthalmic use is the hydrochloride (ate), because it is freely soluble in water. The sulphate, citrate, benzoate and borate have also been used.

Quinine is *incompatible with* ammonia, the alkalies, tannin, iodine and the iodides.

Quinine and its salts have long been employed as a collyrium in various affections of the anterior ocular segment as 1-5 to 1 per cent. solutions but I have not noticed any benefit from this exhibition. Gonzalez (39) says that a 1 per cent. solution of neutral *hydrochlorate (ide) of quinine* is of great value in any suppurative infection of the cornea. The remedy produces a burning sensation which rapidly passes off; there is also some lachrymation. He says that the day after the use of quinine the infiltrated zone of the ulcer is less distinct, the abscess becomes smaller and the cornea gradually clears—all due to the antiseptic action of the remedy.

Reich-Hollender has advised a lotion and cold compress of the hydrochloride. It is to be used as an adjunct to other treatment, especially after the eye has been irrigated with normal salt solution or some similar fluid:

R

Quiniæ hydrochlor.	1.00 (gr. xv),
Aquæ dest.	90.00 (fl.ʒiii).

As a local application in *membranous conjunctivitis* Lawson (*Text-book*, p. 538) has the following:

R

Quiniæ sulph.	gr. iv,
Acid. sulph. dil.	m. ss,
Aquæ dest. ad	fl. ʒi.

W. K. Butler (p. c.), who sees a number of cases of *vernal conjunctivitis* among the mulattoes of Washington, finds the following mixture of decided value:

R

Quiniæ hydrochlor.	0.10-0.30
Vaselin. alb.	10.00.

This ointment is to be applied once or twice daily.

J. S. Mott (p. c.) advises in *corneal ulcer* the following *collyrium* to be dropped into the eye three times daily:

R

Quiniæ sulph.	gr. ii
Atropin. sulph.	gr. iii

Glycerini	fl. 5ss
Aquæ dest. ad	fl. 3iv

# Quinosol.

*Chinosol. Potassium oxyquinolinesulphonate.*

Yellow crystals with an astringent, aromatic taste readily soluble in water.

In 1:1000 solution H. V. Würdemann, (p. c.) finds it of value in the local treatment of *mycotic keratitis*.

# Radium.

*Ra.*

This remarkable and curious metal was discovered in 1898 by Mme. Currie, in pitchblende. The enormous cost of extracting this rare medicinal agent (about \$6,000.00 a gramme), necessarily limits its use. It is found in the market chiefly as a more or less radioactive hydrobromide. Its degree of radioactivity is generally designated by numbers indicating its approach to absolute purity, which is set at 1,000,000.

The salts of radium act by exposure or contact. The radium salt is enclosed in a container, e. g., a sealed glass tube, the latter being brought near the affected ocular tissues. The therapeutic effects of radium are closely allied to those of the  $\alpha$ -rays and are due to the various radiations constantly emanating from the metal or its salts. Radium salts are self-luminous and are capable of producing burns of the tissues which, like Roentgen-ray lesions, are difficult to heal. When first employed a mixture of radium sulphide and barium chloride was placed in a rubber bag or disk container and fastened to the part to be treated.

The *Extra Pharmacopeia* gives the following concise and interesting account of *radium rays*:

They "are of (at least) three kinds: The  $\alpha$  rays, non-penetrating and slightly deviable in a strong magnetic field;  $\beta$  rays, more penetrating than the  $\alpha$ , and deviable. The  $\gamma$  rays, exceedingly penetrating, non-deviable.

*a and b rays.* The  $\alpha$  rays. These are demonstrated by Crookes' Spinthariscopes. The Scintilloscope of Glew shows scintillations direct from radioactive substances. The fluorescent screen causes the  $\alpha$  rays, which are positively charged particles travelling with a velocity of 20,000 miles a second, to be visible as they come in contact with it. Thus zinc sulphide is very sensitive to the  $\alpha$  rays and much less to the  $\beta$ . Barium platino-cyanide and Willemite, on the contrary, are more affected by the  $\beta$  than the  $\alpha$  rays. The mass of these particles is about that of Hydrogen atoms and is enormous in comparison with that of

the particles composing the *b* rays. This accounts for the feeble penetrative power of the former. According to Professor J. J. Thomson, radium energy can proceed for at least 30,000 years. The *a* rays are absorbed by glass, and largely by mica, or a thin sheet of aluminum.

One must recollect that the radium extracted as such now, will 30,000 years hence have almost ceased to exist, but there will have been simultaneously a reformation of no less amount in the mineral from which it was extracted.

The 'law of density' governs the penetration of metals and other substances by these rays, the absorption being proportional to the density. Tin, however, is an exception both for the *a* and *b* rays; for the *a* it is about the same as aluminum, and for the *b* it is about three times as opaque as its density would indicate.

*Polonium*, another radio-active element, discovered by Mme. Curie in pitchblende, gives off *a* rays almost exclusively.

The *b* rays are deviable in an electric field. They are 100 times more penetrating than the *a* rays, being reduced to half value by passage through 0.05 cm. of aluminum. They correspond to the cathode rays in a Crookes' tube, and have a velocity about two-thirds that of light and consist of electro-negatively charged electrons about 1,000 million million times smaller than an atom of hydrogen, and the plus particles of the *a* rays.

In addition to the four radio-active substances already mentioned, a fifth, termed *Actinium*, has been isolated in the ammonium hydrate group from pitchblende. It gives off *b* rays. According to Rutherford the immediate parent of radium is present in this element from pitchblende, but the direct lineal descendant has yet to be settled. Bath water has also been shown to contain radium in small quantity.

The *b* rays in all probability are responsible for the curative results in therapeutics. The *a* and *b* rays 'ionise' the gas through which they pass, making it capable of conducting electricity.

#### *Y-rays.*

The *y* rays are of the nature of X-rays; they are given off by *Thorium* and *Uranium* also, and are about 100 times more penetrating than the *b*, being cut down to half value by 6 to 7 cm. of glass or aluminum, and they will pass through almost everything, even 7 centimetres of lead, before being reduced to 1 per cent. of their original strength. As a matter of fact 99 per cent. of the total energy of radium is due to the *a* rays, the *b* and *y* being responsible for the remainder. The quantity of these (*y*) rays must be so small that the therapeutic effects of radium cannot be due to them.

### Delta Rays.

A new type of radiation designated the *Delta ray* has recently been described by Prof. J. J. Thompson. It is given off by a number of substances, e. g., by an alloy of sodium and potassium, also by *rubidium*, or, rather, by the sublimate obtained by warming rubidium in a vacuum tube, and consists of negatively charged particles traveling at a velocity about one-fiftieth of that of the *b* particle. This ray is, therefore, not very penetrating; it is, in fact, stopped by as small an amount as 2 mm. of air.

*Heat Evolution.* Radium gives off heat, its temperature being always slightly higher than the surrounding atmosphere. It has been calculated that 1 gm. in its existence evolves one thousand million heat units, i. e., 100 gm. calories per gm. per hour, sufficient if converted into work to raise 500 tons of matter a mile, whereas a gm. of hydrogen, our best fuel, burnt in oxygen will only yield 34,000 heat units, or one thirty-thousandth part of the output of radium. It will melt its own weight of ice every hour. This heating is due to the enormous energy of the atoms spontaneously breaking up into the rays already described."

The following information is furnished by the Notes and Queries column of the *Jour. Am. Med. Ass'n*, Oct. 24, 1908:

Radium is sold by Eimer & Amend, New York City. The current prices of different strengths can be learned on application to them. It is handled in commerce in small glass capsules or it may possibly be obtained incorporated in a shellac disc. In the treatment of epithelioma the radium container is applied directly to the lesion. The alpha and beta rays have very little penetrability. In using radium, therefore, it is desirable to use a container having a window of mica or some other material through which the beta rays will penetrate; the alpha rays will not even penetrate this. The duration of the applications vary according to the strength and the quantity of radium used. With fifty milligrams—about 8/10 of a grain—of pure radium bromid, relatively a very large quantity, Williams makes applications of from one to four minutes on alternate days, continuing them until improvement appears in the lesion. Pure radium bromid is estimated at 1,800,000 units activity. With weaker preparations, accordingly longer applications must be made. With a given specimen one needs to increase the applications tentatively until one gets evidences of effect either by improvement in the lesion or by the appearances of a reaction.

Besides the successful treatment of *trachoma* by radium in which, as is well known, long standing cases have been cured *even when com-*

*plicated with pannus, epithelioma, uveitis of various kinds, chronic ophthalmia* of various descriptions, not to mention *simple cutaneous epithelioma, nævi of the lids and papillomata* have disappeared under the radium rays.

One or more of the various radiations from the metallic salts has been used with considerable success in *trachoma, follicular conjunctivitis* and similar diseases. Beck (3) says that the radiations from not less than 50 milligrams of 10,000 radio-activity should be employed and that, as a rule, the greater the activity of the remedial agent the better the results. The salts of the element are thought to be equally active as the metal itself. Birch-Hirschfeld, Fanta and others report cases of severe trachoma treated with radium in a glass tube. The trachoma bodies as well as the surrounding infiltration rapidly disappeared. Its use for the relief of neuralgia and headache, as well as for the treatment of epithelioma must not be forgotten. In all probability this remedy will eventually be found to furnish radiations of the same therapeutic quality as the X-rays.

A *Radio-active Ointment* has recently been patented by a Colorado woman, which consists of *powdered pitch blende* (uranium ore) mixed with lanolin and other ingredients. The ointment in question is claimed to produce continuous radium emanations, without being sufficiently strong to prove a source of danger.

#### **Renaglandin.**

One of the *succedanea* of adrenaline and used like it as a hemostatic and vaso-constrictor.

#### **Renoform.**

One of the numerous fluid extract succedanea of *adrenaline hydrochloride* (q. v.). It is an efficient vaso-constrictor and considerably cheaper than adrenaline. Goldschmidt (*Therapie der Gegenwart*, July, 1903) recommends it as possessing all the good qualities of adrenaline.

#### **Renostyptin.**

Like suprarenine and adrenaline this derivative of the suprarenal capsule is employed as a hemostatic and vaso-constrictor. It possesses, so far as I know, no particular advantage over suprarenaline or similar adrenal extracts.

#### **Resorcin.**

*Resorcinol*, U. S. *Metadioxy-benzene*.  $C_6H_4(OH)_2$ .

This is a diatomic phenol and occurs as white (reddish on exposure to air) crystals with a disagreeable, sweetish taste, and a faint, peculiar odor. It is slightly soluble in water and alcohol; readily soluble in ether and glycerine. It is a local anesthetic and antiseptic and



used as a dermal application in 2 to 4 per cent. solutions in glycerine and water.

Resorcin has been extolled as a remedy for *blepharo-conjunctivitis* in 1 per cent. mixtures with lard, petrolatum, cold cream and other excipients, but I have not found this combination to possess any particular advantage over other and less irritating applications.

In the simple, *hypertrophic form of marginal blepharitis* Gradle advises the following resorcin mixture with sulphur, to be applied to the lid margins at night:

℞

Resorcin.

Lactis sulphur. āā

1.00 (gr. xv),

Vaselini

4.00 (ʒj).

Percy Friedenbergl (p. c.) uses the following mixture, after cleansing of the lid edges, in chronic blepharitis:

℞

Ichthyol.

0.20

Resorcin.

0.30

Lanolin.

5.00

Ungt. aquæ rosæ

5.00

As a *mild astringent*, Lawson, (*Text-book*, p. 538) gives the following collyrium:

℞

Recorcin.

gr. xxxvi

Aquæ dest.

fl. ʒviii

# Roentgen Rays.

(See *X-Rays and Radium*.)

# Romershausen's Eyewater.

This is a collyrium frequently employed throughout Germany in chronic catarrhal conjunctivitis and consists of a mixture of the *tinctura* and the *aqua fœniculi*.

# Rotoin.

A glucoside obtained from *Scopola Japonica* having a cycloplegic action *resembling hyoscin*.

It has been recommended as a substitute for atropia and in the following formula is prescribed for the rupture of posterior synechiæ. It does not irritate the lids even when used for weeks at a time:

℞

Rotoin.

0.05 (gr. i),

Cocain. hydrochlor.

0.10 (gr. iss),

Aquæ dest.

30.00 (fl. ʒi).

**Rubidium Iodide.***Rb I.*

Colorless, cubical crystals, very soluble in water.

I have had no experience with this rare and expensive salt. Its internal action is said to resemble that of potassic iodide but with less influence upon the heart. Bunge, in *Merck's Bericht* for 1893, reports its use as a collyrium (5 per cent. watery solution) in parenchymatous keratitis.

**Saffron.**

(See *Crocus*.)

**Salicylic Acid.**

*Acidum spiricum. Ortho-oxybenzoic acid.*

This acid occurs free in several plants but is extensively prepared from phenol, as small, white acicular crystals of a sweetish-acid taste. It is soluble in about 500 parts of water; much more soluble in alcohol, glycerine and the fixed oils.

It is occasionally employed in collyria (see *Sattler's Solution*), as an astringent and antiseptic in weak solutions as a collyrium—one-fifth to one-third of one per cent. It is commonly prescribed for these purposes in conjunction with other remedies. Its use in ophthalmology is mostly in the internal treatment of gouty and rheumatic diseases. (See *Sodium salicylate*.)

A. E. Prince (p. c.) has long used with success a 10 per cent. solution of salicylic acid in alcohol as an application to *small corneal ulcerations*.

**Salol.**

*Phenyhs salicylas, U. S. Phenyl salicylate.*

Chemically, this salt is a phenylic ester of salicylic acid. It is a white, crystalline powder, sparingly soluble in water, and has a faint, aromatic odor. This antiseptic salt depends upon its components into which it is readily decomposed by the tissues. As a local antiseptic its value is limited by its slight solubility in water (1-2,400). It is rarely used topically in eye diseases, but as an anti-rheumatic remedy in iritis, glaucoma in one to three grammes (15 to 45 grains) or more, daily.

**Sambucus.**

The dried flowers of *Sambucus canadensis* and *niger* are used in medicine. They contain about one-half per cent. of a volatile oil.

*Elderflower water*, official in the British pharmacopeia, is not uncommonly prescribed as a menstruum for ophthalmic remedies. Lawson (*Text-book*, p. 538), gives the following formulæ for its use in

*eczema of the face and eye-lids.* In other prescriptions the same adjuvant is occasionally mentioned by him.

R

Boracis	gr. cxx.
Glycerini	fl. ℥ss.
Aquæ sambuci	fl. ℥ii
Aquæ dest. ad	fl. ℥viii.

Or:

R

Acid. hydrocyanici dil.	m. xl
Aquæ sambuci	fl. ℥ii
Aquæ dest. ad.	fl. ℥viii

### Sanoform.

*Methyl-ester. Diiodosalicylic acid.*

The result of the action of iodine on methyl salicylate. A colorless, odorless, tasteless powder, insoluble in water but dissolved by alcohol and ether. In the form of a 10 per cent. ointment or as a dusting powder it is recommended in *purulent conjunctivitis*.

### Sassafras.

*Cinnamon wood. Ague Tree. Saloop. Sassafras bark. Savi-frax.*

The part generally employed in medicine is the bark of *Sassafras sassafras*, which contains an important volatile oil (6 to 9 per cent.), some tannin and an active principle called *sassafrid*.

So far as the eye is concerned the dried pith of the stem (*Sassafras Medulla* U. S.) interests us most because from it is made a mucilaginous liquid, recognized officially as *Mucilago Sassafras Medullæ* U. S., that acts as a soothing and effective collyrium in *acute conjunctivitis* and serves, also, as a vehicle for more active remedies.

### Sattler's Solution.

*Sattler's Eyewater.*

A collyrium used in acute conjunctivitis, recent trachoma and other inflammatory diseases of the external eye.

R

Acid. salicylic.	1.0 (gr. xv)
Acid. boric.	15.0 (℥i gr. xlvi)
Aquæ dest.	500.0 (fl. ℥xvi).

### Schleich's Salt.

In the employment of Schleich's *infiltration anesthesia method* it is convenient to have a properly prepared fresh, sterile solution at

hand for intradermal injection. This need is met by the use of tablets each of which is to be dissolved in 100 cc. of sterilized water, thus making the necessary infiltration fluid. As prepared for the market they can be had in *three* strengths, as follows:

	1.	2.	3.
	Strong.	Normal.	Weak.
Cocaine hydrochlor . . . . .	0.20	0.10	0.01
Morphia . . . . .	0.025	0.025	0.005
Sodium chloride . . . . .	0.20	0.20	0.20

### **Sclarea.**

The flowers of this plant—*Salvia sclarea*—are made into an *infusion* and used as a domestic remedy in various form of “sore eyes,” just as *chamomile* (q. v.) “tea” is employed abroad. The plant contains a small amount of *tannin* and *volatile oil* to which, presumably, its virtues are due.

### **Scopolamine.**

#### *Hyoscine.*

It obtains its first name from *Scopola carniolica*, or Japanese belladonna, from which, with some atropine and hyoscyanine, it may be obtained.

This cycloplegic agent commonly occurs as the hydrochloride ( $C_{17}H_{23}NO_5HCl_2$ ) and hydrobromide, in rhomboid, transparent crystals very soluble in water, less soluble in alcohol. It is *chemically, physiologically and clinically identical with hyoscin* (q. v.), and is given a heading here to emphasize that fact.

### **Scopomorphin.**

The trade (Riedel, Berlin) name of a mixture containing *scopolamine hydrobromide*, gr. 1/50, *morphia hydrochloride*, gr 1/2, *distilled water*, thirty minims, to be used for injection in *general anesthesia* (q. v.). Ten minims are to be injected 3 hours before the proposed eye operation and another ten minims an hour and a half later. It is rarely necessary to use the remaining ten minims. Cocaine may be combined with this preparation to lessen still further the local irritation.

### **Scott's Mixture.**

(See *Hydrastin*.)

### **Silver Acetate.**

*Argentac acetate.*  $C_2H_3O_2Ag$ .

Minute, white crystals, of a disagreeable, metallic taste, soluble in 100 parts of cold and 15 parts of boiling water; slightly soluble in alcohol.

This drug, in one per cent. solution, has been employed with suc-

cess as a *substitute for the nitrate*, especially in the *prophylactic treatment of ophthalmia neonatorum*. In *Guthrie's Salve* (q. v.) and in such mixtures as the following, silver acetate is formed in a greater or less proportion:

R	
Argent. nit.	0.4 gm. (gr. vi)
Liq. plumbi acet.	gtt. iv.
Ungt. paraffini	8.0 gm. (3ii)

According to Merck's reports for 1906, Zweifel pointed out years ago the advantages of *silver acetate as compared with silver nitrate* for the prophylactic treatment of *gonorrhea neonatorum*; this view was shared by Scripiades and Bischoff, while Leopold and Dauber held silver nitrate to be the better remedy. J. Thies held that, the two being of equal efficacy, the only possible advantage of one over the other would be due to a greater tendency of one to produce irritant appearances. To settle this matter the author made trials with 2,000 children; after mechanically cleansing the eyes, he placed into the right eye a few drops of a 1 per cent. solution of silver acetate, into the left eye a few drops of the usual 2 per cent. silver nitrate solution. The eyes were then bathed with normal saline solution. He found silver acetate to work better than silver nitrate, although the difference was not great. It has other properties, however, which would appear to make it more suitable to the needs of practice than the nitrate. While the latter is readily soluble in water, and its solutions may gradually become more concentrated by evaporation, silver acetate crystallizes out as soon as a concentration of 1.2:100 is reached. Thus the danger of using too concentrated a solution is entirely precluded with silver acetate. A further advantage of the acetate is said to exist in the fact that in case silver becomes set free from the solution the acetic acid thus liberated is less irritant than the nitric acid set free, under similar circumstances from the nitrate. For *prophylactic treatment in midwifery the acetate would thus appear to be preferable to the nitrate of silver*.

Seefelder,\* like Zweifel and Thies, gives silver acetate the *preference over silver nitrate in the prophylaxis of gonorrhea neonatorum*. In 500 cases in which he used a 1 p. c. solution of silver acetate, he did not observe an irritant effect in a single case.

After instilling the silver acetate drops, no injury to the corneal epithelium was observable, the cornea remaining always perfectly clear, shining and transparent. Only in children of 1 to 4 days of age was a slight inflammation of the conjunctiva observed.

\**Münchener med. Wochenschrift*, 1907, No. 10, p. 475.

## CHAPTER XXIX.

### REMEDIAL AGENTS EMPLOYED IN THE LOCAL TREATMENT OF EYE DISEASES—CONTINUED.

*Silver and its Salts—Silver Citrate—Silver Fluoride—Silver Lactate—Silver, Metallic—Silver Nitrate—Silver Sulphophenate—Silver Vitelline—Sodium Benzoate—Sodium Benzosulphinide—Sodium Borate—Sodium Bicarbonate—Sodium Chloride—Sodium Cinnamate—Sodium Iodide—Sodium Saccharate—Sodium Saccharin—Sodium Salicylate—Sodium Sozoiodolate—Sodium Sulphate—Solution of Chlorinated Soda—Sophol—Sozoiodole—Sozoiodole—Zinc—Spiritus Etheris Nitrosi—Stovaine—Starch—Streptococcus Serum—Sublimite—Sublamine—Sugar.*

#### Silver and its Salts.

These drugs have long been regarded as among the most useful of our therapeutic agents and their popularity is shown by the embarrassing number of argentic compounds put on the market in recent years. I have endeavored to treat most of these—and their name is legion—on their merits, both individually and collectively, and to that end have experimented with each as they were accessible to me. Speaking generally I am quite of the opinion that where an argentic compound is urgently needed, as in ophthalmia neonatorum, adult gonorrheal conjunctivitis and the other blennorrhoeas there is no substitute for the nitrate. Valuable as are argyrol and other mild preparations, I believe that in efficacy they are inferior to the older preparation.

In addition to the nitrate numerous other (mostly metallic) salts of silver have been recommended in ophthalmology; for example, the acetate, benzoate, borate, cinnamate, citrate, eosolate, iodate, iodide, lactate, oxide, permanganate, phenolsulphonate, salicylate, sulphate and tartrate. Several of these, as well as others not included in this list, will be separately considered.

In this connection the British Medical Association report of Marshall and Neave (8) on a few of the recently marketed silver-salts as compared with the nitrate is of great interest. First, the percentage of metallic silver was found in each remedy as follows:

Collargol, 86.6; silver fluoride, 81.7; silver nitrate, 63.6; itrol, 60.8; actol, 51.5; argentol, 31.2; ichthargan, 27.1; argyrol, 20.0; albargin, 13.4; nargol, 9.6; largin, 9.4; novargan, 7.9; protargol, 7.4; argentamine, 6.4; argonin, 3.8.



These results were used in preparing the various solutions. Each solution was made to contain a definite percentage of silver. This appeared to be the only method available for comparison, as equimolecular solutions could not be employed owing to the composition of many of the substances being unknown.

The results are given as obtained with a mixed culture and with a pure culture of *staphylococcus pyogenes aureus*. The antiseptic action was determined by observing the time taken by minced, cooked beef to putrefy in the presence of solutions of silver compounds of known strength, and by inoculating an agar mixture.

The experiments showed that as regards *bactericidal action* the various silver compounds investigated fall into three groups: (1) Those which are powerfully bactericidal; (2) one—nargol—much less powerfully bactericidal; (3) two—argyrol and collargol—which possess practically no bactericidal action whatever.

The first group includes most of the substances investigated, namely, silver nitrate, silver fluoride, actol, itrol, argentamin, argentol, albargin, argonin, ichthargan, largin, novargan and protargol. The bactericidal action of these, in solutions containing the same percentage of combined silver, is closely similar, and it is practically impossible to place them in any order of activity which would be true under all circumstances."

C. C. McCullough (p. c.) has used *argyrol* in solutions up to 60 per cent. in many cases of *gonorrheal ophthalmia* and *ophthalmia neonatorum* and has never had a corneal ulceration.

J. F. Dickson (p. c.) uses *argyrol* whenever he requires a silver preparation, but prefers it in strong solutions—10 to 30 per cent. When it seems to lose its effect he resorts to a few applications of silver nitrate, again to return to the argyrol which then seems to be as effective as ever.

Demandre (*Repertoire de Pharmacie*) says that "argyrol is decomposed by light and is attacked by hydrochloric acid. Alkaline chlorides yield with argyrol a precipitate of silver chloride. The hydrochloride of pilocarpine should never be prescribed with argyrol owing to the formation of a brown precipitate; the nitrate of pilocarpine, however, does not decompose argyrol. The addition of adrenalin to argyrol in solution leads to similar changes to those produced in the case of hydrochloric acid. Cocaine hydrochloride in solution is immediately and completely decomposed by argyrol and the same result is obtained with the sulphate of copper and zinc. Argyrol is decomposed by several other compounds, including the hydrochlorides of morphine, heroin, quinine, cinchonine, and sparteine. Both argyrol

and protargol may be prescribed with the hydrochlorides of cocaine, tropacocaine, alpha eucaine, holocaine, and *novocaine* if these substances are dissolved in a 1.5 per cent. aqueous solution of boric acid. These observations respecting two of the important organic compounds of silver will probably be found useful in the case of others of this class."

Stephenson believes (*Ophthalmoscope*, August, 1908) that the *correct preparation of solutions of argyrol and of protargol* is a matter of some practical moment. The medicament should be dusted on the surface of the water, which is then allowed to stand without stirring. Heat must never be employed to facilitate the solution, inasmuch as it may lead to the formation of irritating substances. Stock solutions should be sedulously avoided. Steinkuhler\* recommends the use of tablets, each of which contains 0.25 gramme, as a convenient means of preparing fresh solutions of protargol. Burroughs, Wellcome & Co., prepare both *tabloids* (q. v.) and *soloids* (q. v.) of argyrol, the former containing gr. 1/24 and the latter gr. 1 of the compound.

Burdon-Cooper\*\* believes that as far as *argyrosis* is concerned the essential element in determining the stain is the soluble chlorides of the tissues. It is chloride of silver that is decomposed by light, not an albuminous material. The soluble chlorides influence the rate of penetration of silver nitrate. The depth of penetration is a function of the concentration of the silver solution. The seat of the stain is determined by the soluble chloride, and is also dependent on the strength of the solution. The brown stain is either argentous chloride or an oxychloride of silver. The black stain is either metallic silver or the black oxide, probably the former. Drops are more potent in causing a stain than an application of a stronger solution by the brush.

In any event, there seems to be a widespread suspicion that in serious cases *there is no silver salt equal to the nitrate of silver in full doses*. G. K. Talley (p. c.) is convinced that if climate has anything to do with it the nitrate of silver, in fairly concentrated solutions (30-60 grs. to oz.), is a far better remedy for the so-called granular lids than any of the newer silver salts (argyrol, protargol, etc.). He writes, "You are aware that the statement has been made that these latter salts in 30 to 50 per cent. solution will do all and more than the nitrate—but they won't in Texas."

C. S. G. Nagel (p. c.) reports that he has, by parallel tests in fellow eyes, proven to his own satisfaction that in gonococcic and other

---

\**Woch. f. Ther. u. Hygiene des Auges*, Nov. 2, 1905.

\*\**The Ophthalmoscope*, June, 1907.

virulent forms of blennorrhœa *silver nitrate is the salt to be depended upon* and that it is decidedly superior to argyrol or other recently discovered substitute.

R. Denig (p. c.) concludes that *nitrate of silver is still superior to the much-advertised protargol or argyrol.*

R. L. Randolph (p. c.) *places no confidence in any of the silver salts except the nitrate when it comes to gonorrheal infection of the conjunctiva.* He has always held that it is great risk to experiment with the other salts. He believes that much of the success that he has met with in treating this serious condition is due to freely "opening up" or scarifying the conjunctiva particularly near the corneal border, treating the area just as one would an infected area elsewhere in the body. *The free bleeding always betters the condition.*

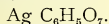
E. M. Alger (p. c.) informs me that he has made use of the following adjuvant and finds that it makes a remarkably stable mixture:

R

Argent. nitrat.	gr. i-xx
Spt. ether, nitros.	fl. ʒi.
Aquæ dest.	fl. ʒss

Most soluble salts of silver are *incompatible* with acetates, alcohol, alkalies, chlorides, copper salts, extracts, iodides, morphia and its derivatives, oils, organic substances, tannin and vegetable astringents, decoctions and infusions.

#### Silver Citrate.



A white powder or in acicular crystals, soluble in 4000 parts of water.

As a collyrium this preparation has been used as an *antiseptic and astringent eyewater in the proportion of 1:10000 to 1:4000 of distilled water.* Solutions should always be fresh.

Gawalowski has produced a soluble carbonate of silver which forms a clear, colorless, water solution, having a neutral reaction and containing 0.25 gm. of silver in every 100 c. c. It will keep unchanged for several months if protected from the air, and may be used in place of the nitrate of silver. It is claimed to be non-irritant and to be decidedly astringent and antiseptic.

#### Silver Fluoride.



When carbonate or oxide of silver is treated with hydrofluoric acid a very deliquescent, yellowish-white mass remains, which may be evaporated to dryness. The resulting crystalline conglomeration dark-

ens if exposed to light. It is soluble in water, has marked antiseptic properties and is used generally in 1-5,000 aqueous solution, as a substitute for silver nitrate. (See *Silver and its salts*.)

#### Silver Iodide.

A heavy, light yellow, tasteless powder, unaltered by light if pure, insoluble in water or alcohol.

Silver iodide is rarely used in medicine owing to its extreme insolubility in human fluids or in ordinary menstrua. However, the active agent in the following mixture, a popular collyrium in the treatment of *trachoma* (q. v.), is silver iodide, produced by the action of potassium iodide on silver nitrate. It occurs, in the mixture, in the form of suspension.

(Formula A.)

R	
Argenti nitratis.	ʒii
Glycerin.	fl. ʒss
Aquæ dest.	fl. ʒii

(Formula B.)

R	
Pot. iodid.	ʒ ss
Glycerin.	fl. ʒi
Aquæ dest.	fl. ʒss

Mix thoroughly three drops of Formula A with 6 drops of Formula B. Instill three or four drops of the mixture on the everted lids every morning. Use separate pipettes for making the mixture and putting it into the eye.

#### Silver Lactate.

As  $C_3H_5O_3 + H_2O$ . White powder or crystals. Much affected by light and should be kept in amber-colored bottles. Soluble in 20 parts of cold water.

As an *astringent* and *antiseptic* it is employed as a *collyrium* in the milder forms of *conjunctivitis with secretion*, in solutions of 1:4000 to 1:2000. The lids may be brushed with stronger solutions, one-half to five per cent., afterwards neutralizing with 5 per cent. sodium chloride.

#### Silver, Metallic.

(See *Argentum colloidal*.)

#### Silver Nitrate.

*Lunar caustic.*  $AgNO_3$ .

The use in ophthalmic practice of silver nitrate is mentioned in the text-book of St. Yves.\* Its employment for this purpose was re-

\*Graefe, *Archiv, für Ophthalm.*, 1854, II., p. 199.

viewed by Graefe and it has since continued to be, on the whole, the most reliable astringent-antiseptic we possess.

In the article referred to von Graefe warns the reader that silver nitrate must be judiciously and cautiously used, that a careful diagnosis should be made before its use, its effects should be watched and that the remedy be discontinued, modified or increased in its dose, as the conditions warrant.

In acute cases of conjunctivitis von Graefe applied a two per cent. solution or a "*mitigated stick*" made by fusing together equal parts of silver and sodium nitrate. These were applied once or oftener and their effects controlled by salt water, in the case of the solid stick, and by simple water irrigation when the solution was instilled. The effect of either application was further increased or diminished by varying the length of time allowed to intervene between it and the use of the water or neutralizing solution.

As an adjunct to this treatment, when edema of the conjunctiva is associated with much muco-purulent discharge, von Graefe advised, immediately after these applications scarification of the swollen mucous membrane. He further advised that the silver application should not be made so long as there were visible any whitish or yellowish-white exudates or areas, the result of previous cauterizations. On the whole a thorough use of the remedy once or twice a day is sufficient. Although he was at first of an opposite opinion von Graefe finally concluded that in *blennorrhoea conjunctivae* implication of the cornea did not contra-indicate the use of nitrate of silver even in large doses, although he always stood fast to the dictum that it should never be used in diphtheric conjunctivitis, especially when the false membrane is well formed.

The usual form of applying silver nitrate is the solution, from one-fifth to twenty per cent., although the caustic "*stick*" (*argenti nitratus*, moulded silver nitrate) is employed as an escharotic (q. v.) and occasionally used to burn exuberant granulations from the ocular region. It is needless to say that strong solutions should be applied with great care and only to the everted lids (preferably with a cotton applicator or camel-hair brush) which are afterwards irrigated with a five or ten per cent. salt solution. In spite of the fact that strong solutions (3 to 10 per cent.) of silver nitrate are decidedly irritant and painful it is probable that they are the most reliable antiseptic-astringents we possess, that in profuse mucopurulent conjunctivitis of any variety they ought to be thoroughly but judiciously employed. On the other hand, weak solutions (1-5 to 1 per cent.) possess no advantage over the astringents, especially over the newly-introduced organic

compounds of silver, such as argyrol and argentamin. As time passes one may reasonably expect the nitrate to be used in gonococcus ophthalmia and the severer types of pneumococcus and other purulent infections of the conjunctiva, while the milder infections are treated by other remedies.

It must be remembered that the continued use of even weak preparations of silver nitrate, as is the case with soluble argentic salts, may end in staining (*argyrosis*) of the conjunctiva.

M. H. Bell (p. c.) believes in full doses of silver nitrate in specific and non-specific blennorrhoea *as soon as the diagnosis of a serious infection is made*. Instead of waiting, as some advise, until the purulent discharge has set in he *uses it from the very commencement* on the supposition that the action of the antiseptic is mainly directed as a germicide against the bacterial invasion and before they have penetrated deeply into the mucous membrane. He has followed this rule in 15 or 20 cases and has not so far noticed a corneal involvement.

John S. Kirkendall (p. c.) much prefers strong solutions and generally uses *forty grains to the ounce of distilled water as a single application* in all cases of gonorrhoea of the conjunctiva, both infantile and adult. Since the adoption of this plan 15 years ago he has never lost an eye or had a scar of the cornea, although previously both of these accidents occurred. He *everts both lids and applies the silver solution thoroughly to the exposed mucosa*, afterwards washing it off with a strong salt solution. This is followed by the use of argyrol every hour, cold applications and thorough cleanliness. He is rarely obliged to use the strong silver solution a second time and has never seen an instance of chemosis of the conjunctiva or corneal implication of any kind, following its application.

The irritation, especially burning, smarting and pain set up by the applications of nitrate of silver or, indeed any other of the stronger astringents, may be relieved by *bathing the closed eyes with ice-cold water*. (See *Cold Applications*.) For this purpose Percy Friedenberg (p. c.) adds to the ice water, a tablespoonful to a pint, the following:

R

Spt. lavendulæ.	
Spt. camphoræ.	
Spt. nitri. dulc. aa.	30.00
Spt. odorat. (Colognens.)	60.00
Spt. vini. gallici	60.00
Spt. myrciæ ad.	240.00

C. L. Frey (p. c.) regards as useless the directions to keep solu-



tions of silver nitrate in actinic or dark glass bottles. He says: "This has only the effect of covering solutions that have decomposed and that ought to be thrown away and in no wise preserves a good solution. Properly made, solution of silver nitrate is no more affected by sunlight than is a bottle of alcohol or distilled water. Nearly twenty years ago he called the attention of Nettleship to this matter. That well-known ophthalmologist repeated the experiments made by Frey and in a letter to him said that he "entirely agreed with his conclusions."

Hirschberg (43) claims that the effect of this very old ophthalmic remedy is due to the formation, with the superficial tissues, of an insoluble silver albuminate, which being thrown off carries with it the bacteria entangled, as it were, in its meshes. His classic rule for the use of silver nitrate may here be quoted: A half per cent, solution for catarrhal conjunctivitis; one per cent. in trachoma and two per cent for blennorrhea.

In gonococcic and other forms of purulent conjunctivitis the treatment by silver nitrate has always been a favorite, although the most varied opinions have been rife as to the dosage, frequency and method of its application. Personally, I am in favor of exhibiting this remedy in small (1-5 to 1 per cent.) solutions in frequent doses as an eye-water, painting the stronger (2 to 20 per cent.) solutions myself over the everted lids and neutralizing them with 5 per cent. salt solutions. The prolonged use of this and other silver salts is likely to be followed by staining of the conjunctiva. That a local argyrosis (grayish discoloration) may thus be induced should always be borne in mind, although it is only fair to say that conjunctival staining from silver nitrate is, in modern times, a rather rare phenomenon. Solutions of the nitrate should be made with distilled water, lest it throw down the insoluble silver chloride, in combination with the chlorides of sodium, potassium and magnesium that almost every natural water contains.

Generally speaking, the most successful employment of this remedy is in the various forms of conjunctivitis associated with a maximum amount of mucous and purulent secretion, and with a minimum of pain or irritation. It is particularly valuable in the blennorrhea of gonorrhea, both infantile and adult, as well as of streptococcus, staphylococcus, pneumococcus and "mixed" infections.

As an ointment nitrate of silver has long been used, particularly in ulcerative and other varieties of blepharitis. It forms the chief

ingredient of Guthrie's salve (q. v.) but may be used alone with petrolatum in the proportion of a quarter to a half per cent.

As a prophylactic in all forms of ophthalmia neonatorum, Credé's method—one drop of a 2 per cent. solution dropped into the cleansed conjunctival sac at birth—still stands as the safest plan yet discovered.

For other purposes than those just mentioned, there are, doubtless, satisfactory substitutes [mainly salts of silver, such as argyrol, argentamin, protargol] for the nitrate. These may be equally efficacious, less irritating and less likely to produce pain, but if prescribed with judgment it seems likely that silver nitrate will continue to be of signal service to the ophthalmologist.

#### **Silver Sulphophenate.**

*Silver sulphocarbolate. Silver phenolsulphate.*

Found as colorless, odorless prismatic crystals with a marked metallic taste; soluble in 3 parts of water and 60 of alcohol. The aqueous solution, decomposed by light and heat, is used like itrol and argonin (q. v.) in ophthalmic practice in 1-500 to 100 solution and as a substitute for silver nitrate in half the strength of the latter.

#### **Silver Vitelline.**

(See *Argyrol*.)

#### **Soap.**

*Hard soap. Sapo. Sapo durus. Castile soap.*

Although the name "soap" is generally applied to the foregoing product, made from olive or some other fixed vegetable oil and sodium hydroxide, yet it is generally used for all compounds of fatty acids with alkaline bases. With earth bases or metals the product is insoluble, such as lead plaster and lime liniment.

*Soft soap (sapo mollis, sapo viridis, green soap)* is made from *potassium* hydroxide and olive, almond, linseed or similar oil.

*Curd soap*, tallow or animal soap, made from tallow or suet, is sold in very light grayish masses or cakes.

Liniments, tinctures and other preparations, official and other, are employed for cleansing the skin.

Although this detergent remedy is never applied to the eyeball or conjunctiva, it is a most useful adjunct to sterilization of the lid skin and the dermal field of operation. As a *preliminary to the application of ointments in blepharitis* various forms of soap are used for cleansing purposes, one of the best of these being pure *castile soap*. A lather made with it may be rubbed with impunity on the margins of the lids with sterile cotton in diseases of that locality as well as in the attempt to sterilize the cilia and palpebral edges previous to operation.

# Sodium Benzoate.



A white, partially crystalline powder, odorless but of a sweet-astringent taste. It is very soluble in water; sparingly in alcohol.

Among the numerous germicides proposed for ophthalmic use during the past twenty years this agent for a short time held a minor place, having been recommended as a collyrium in 1 to 5 per cent. solution. I do not believe that it possesses any advantage over most other antiseptics. It resembles in its clinical relations to eye diseases boric and salicylic acids.

# Sodium Benzoesulphinide.

*Sodium benzoysulphonate. Orthosulphaminebenzoate. Sodium salt of Saccharin.* Sometimes, though incorrectly, called "*sodium saccharate*" (q. v.).

Colorless crystals, very soluble in water. It is an antiseptic employed in solutions of 1:6 to 1:3 in *keratitis, corneal ulcer, iritis*, etc.

# Sodium Borate.

*Borax. Sodii boras, U. S. Natrium biboricum. Sodium tetraborate or pyroborate.*  $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ . Occasionally, *biborate of sodium*.

This well-known and valuable salt, derived from commercial boric acid, is found in large, colorless, inodorous prisms that have a mild, sweetish, cooling and alkaline taste. It readily effloresces and becomes opaque.

Borax is often combined in collyria with boric acid and other agents, but it may, in 1 to 5 per cent. solutions, be used alone as a mild and soothing detergent in almost every form of conjunctival disease. As a general statement it can be said that borax is indicated in about the same dosage and for the same purposes as boracic acid (q. v.), although its antiseptic value is less. It makes a good collyrium and detergent wash in *conjunctival catarrh and hyperemia*. A favorite formula is:

R

Sodii boratis	1.0 gm. (gr. xv)
Aquæ laurocerasi	5.0 c.c.
Aquæ rosæ	
Aquæ dest.	ââ 100.0 c.c. (f3iij f3iij)

# Sodium Bicarbonate.

It seems strange that this salt is so little used in ophthalmic therapy because it makes a good collyrium for detergent purposes, for irrigating the sac during the treatment of infective diseases of the eye

and as a wash for the lid edges in cleansing the cilia, skin and adjoining mucous membrane from dried secretions. For all these purposes a 1 to 3 per cent. solution in distilled water is quite sufficient. Konigstein and others recommend it in ointments of potassic iodide, as in this formula:

R	
Potass. iodidi	0.1 gm. (gr. iss)
Sodii bicarb.	0.05 gm. (gr. 7-10)
Petrolati	3.0 gm. (gr. xlvi)

In painful, *marginal ulcer of the cornea* Darier recommends the following collyrium, of which this salt forms a part. One drop is to be instilled into the eye from four to six times a day:

R	
Dionin.	
Cocain. hydrochlor. āā	0.10
Sodii bicarb.	0.20
Aquæ dest.	10.00

### Sodium Chloride.

*Common salt.* NaCl.

Although it is generally held that the terms "physiological salt (or saline) solution" and "normal salt solution" are not synonymous terms the National Dispensatory remarks that the "saline strength of these solutions is supposed to be the same as that of blood serum and varies, according to different authorities, from six-tenths to nine-tenths per cent. or, as it is roughly calculated, one teaspoonful of sodium chloride to one pint of water."

Sodium chloride in various aqueous solutions forms a valuable douche to the eye, for irrigating the conjunctival sac, for subconjunctival and intraocular injections, for controlling the effect of silver nitrate and for other purposes. As normal salt solution the douche and spray act mechanically in freeing the sac and eyeball of toxins and microbes; in *subconjunctival medication* it is employed in from 0.60 to 20 per cent. solution, according to the effect desired; I prefer the former solution for detergent purposes.

T. S. Middleton (p. c.) orders the following ingredients to be made up into four tablets, one or two of which are to be dissolved in an ounce of boiled water and used as a *collyrium* and *compress* in the home treatment of *simple catarrhal conjunctivitis*.

R	
Acid. boric.	ʒss

Sodii, chlor. gr. xii

Aquæ camphor.

Aquæ menth. pip. āā m. xvi

This method insures freshness of the solution.

### Sodium Cinnamate.

(See *Hctol.*)

### Sodium Hyposulphite.

*Sodii thiosulphas*, U. S. *Sodium thiosulphate*.  $\text{Na}_2\text{S}_2\text{O}_3 + 5\text{H}_2\text{O}$ .

Occurs in large, transparent, colorless, odorless prisms with a cooling, bitter, alkaline taste. It is very soluble in water and is generally used as an antizymotic, like the true sulphites.

Jackson (*Text-book*, p. 256) advises the employment of 5 to 10 *per cent solutions* of this salt in the treatment of *Parinaud's conjunctivitis*.

### Sodium Iodide.

*Natrium iodatum*, P. G. NaI.

This salt, when anhydrous, occurs as a white, inodorous, crystalline powder, with a saline, bitterish taste. It is very soluble in water and alcohol; soluble in glycerine.

Sodium iodide is used as a substitute for potassic iodide both internally and locally in the same dosage and is given in the same manner. (See *Potassium iodide*.) It is preferred by some ophthalmologists who believe it to be less toxic and less irritating to the ocular tissues.

Schiele (17) found its *subconjunctival action* of especial value. He used 0.10 solutions (not boiled but freshly prepared) to which from one to three drops of a 1 *per cent. solution of acoin* (q. v.) were added to each syringe-ful to make the injections painless. The conjunctiva was first anesthetized by instillations of cocain, or cocain and atribilin. Pain after the injections was either very slight or entirely absent. No edema of the conjunctiva or swelling of the eyelids was seen in any case. The injections were made far back from the cornea, to avoid injuring any of the large conjunctival vessels. No adhesion between the conjunctiva and sclera, or necrosis of the tissue was observed. These injections of a syringe-ful of 1-1,000 sodium iodide solutions were repeated not oftener than every three or four days, and were used in *iritis*, *cyclitis*, *keratitis*, *secondary glaucoma*, and *panophthalmitis* with marked relief of the pain, which decreased decidedly within a few hours, disappeared entirely or was slight afterwards.

To bring about *absorption of the plaques of scleritis*, massage with the following mixture has been found extremely helpful:

℞

Sodii iodidi	0.25
Petrolati	10.00.

To be used in conjunction with other treatment.

### Sodium Saccharate.

More properly, *sodium saccharin*. *Soluble gluside*. *Soluble saccharin*.

Made from aqueous solutions of saccharin with sodium carbonate. It occurs in colorless, intensely sweet crystals, very soluble in water.

In *intractable, though superficial ulcer of the cornea*, Webster Fox (*Text-book*, p. 157) has found *subconjunctival injections* of great value. He uses the following formula:

℞

Sodii saccharat.	gr. xv
Aquæ dest.	fl. ʒi

### Sodium Saccharin.

(See *Sodium benzosulphinide* and *Sodium saccharate*.)

### Sodium Salicylate.

*Natrium salicylicum*, P. G.  $\text{NaC}_7\text{H}_5\text{O}_3$ .

A fine, white, crystalline powder with a faint odor and a sweetish saline or alkaline taste. It is freely soluble in water, glycerine, and alcohol. Its solutions are feebly acid.

Comparatively few of the many compounds of sodium are used in ophthalmic surgery although these few are among our most valuable remedies. They are in particular *incompatible with* acids and vegetable astringents. As a rule they are employed as detergents, irrigating fluids and in collyria.

Although we are best acquainted with this drug as an anti-rheumatic agent given internally it must not be forgotten that it is also of great value in ocular affections of a different origin, that it has been extensively employed in the form of sub-conjunctival injections and even as the chief constituent of collyria.

In the form of sub-conjunctival medication (0.025 of the salicylate with 0.005 grm. of cocaine) van Moll (63) was among the first to use it.

The best results in the internal exhibition of this remedy are obtainable only by the observance of certain rules, first formulated by Harold Gifford (11). He advises its use in all *non-specific inflammations of the iris, ciliary body, sclera and episcleral tissues*, whether of rheumatic origin or not; in acute retrobulbar neuritis and



in glaucoma. He has found the average patient will stand during the waking hours, i. e., 7 a. m. to 10 p. m., one grain to each pound of his weight, and gives it as follows: One ounce of the salicylate is dissolved in four ounces of brandy, which gives approximately 15 grains to the teaspoonful. This is administered every 1½ hours in about 1-8 glass of water followed by the same amount of water or a cracker to get rid of the taste; it is best to begin with a smaller amount at first and the patient should go to bed after the third or fourth dose, being allowed to go without the drug for a day or two each third or fourth day. He is also warned to keep the head wiped dry, if there is perspiration, as a severe cold may be taken. If the stomach rebels a change to giving the drug in capsules, followed by the brandy and water, may be resorted to. Temporary blindness and deafness, as toxic sequels, are extremely exceptional and need have no more weight than the blindness which results from moderate doses of quinine. Some cases of delirium have been reported following its use. The writer has tried aspirin with about the same unpleasant symptoms when enough to produce good results was exhibited. In cases classed as optic neuritis, there are many conditions not really inflammatory, but due to stasis or thrombosis, in which more faith is placed in large doses of the iodides than of the salicylate; as also in posterior chorioretinitis. Special stress is laid upon the use of this salicylate in *sympathetic ophthalmia, post-operative or traumatic inflammations of the iris and ciliary body, interstitial keratitis and herpes corneæ*.

In sympathetic ophthalmia Gifford places it ahead of mercurial inunctions but frequently uses the two alternately. Emphasis is laid upon the necessity of keeping up the use of the salicylate one or two days a week for a long time after the last sign of acute inflammation has disappeared.

In *interstitial keratitis*, plainly the result of hereditary syphilis, the action of the salicylate is much less active and certain than in those that show no marked luetic signs, but even here it often does more good than both iodides and mercury. Those cases of iritis that not infrequently occur after cataract extraction respond most promptly to the generous use of the drug.

In *herpes corneæ* the use of the salicylate in connection with local applications of an iodide gives relief where hot applications and atropine fail.

In explaining the drug's action, the rapid elimination from the body by the kidneys is against its being a germicide or germ-hindering substance, as a 1-1,000 to 1-500 solution is necessary to check the

growth of ordinary white and yellow pus cocci. The theory of Oltramare is more plausible, according to which "a local depletion is produced by general capillary dilatation which the salicylate causes." In this connection reference is made to the remarkably favorable influence which an optico-ciliary neurectomy (in which a large part of the blood supply to the eye is cut off) exerts upon traumatic inflammations, and the action of cardiac depressants in checking colds. The diaphoresis produced is considered as a secondary factor in the good influences produced by the drug.

Since the date of van Moll's paper, just referred to, it has been discovered (see Sub-conjunctival Injections) that sodic chloride and other less irritant salts are as clinically useful in kerato-iritis and scleritis, so that the salicylate is now less rarely used in that form.

As a wash in erythema of the lids Ohlemann (*loco cit*) advises the following mixture:

R	
Mist. oleoso-balsamicæ	1.50 (gr. xxiii)
Sodii salicylatis	3.0 (gr. xlv)
Aquæ dest.	150.0 (f ̄ iv, f ̄ vi)

#### Sodium Sozoiodolate.

##### *Sozoiodole-Sodium.*

One of a numerous class of organic compounds with metallic bases (aluminum, zinc, potassium, silver, mercury, lead) and preferred on account of its great solubility (1:3) in water. It occurs as odorless, colorless, acicular crystals and is applied as a salve with lanoline, or used as a 2 to 8 per cent. collyrium.

I have had no experience of this salt, official in the German pharmacopeia, and can only repeat the advice of others. It has been recommended by Goldzieher in all small and medium sized *ulcers of the cornea* and as a stimulant to absorption of the exudates in *parenchymatous keratitis* in the form of a half to one per cent. ointment with massage and in conjunction with atropia. The same writer has successfully applied this remedy in cases of *scleritis* as a 1:40 ointment in vaselin.

#### Sodium Sulphate.

##### *Glauber's Salt. Natrium sulfuricum. Na<sub>2</sub>SO<sub>4</sub>.*

This well known salt crystallizes in large, transparent, colorless, odorless prisms, having a saline, cooling but bitter taste. It is quite soluble in water.

Some years ago I drew attention in *Hare's Therapeutics* to its use as a cleansing lotion for *acute catarrhal conjunctivitis with secretion*,

but I have not since seen a reference to its employment in the local treatment of eye diseases. I then advocated the following:

R

Sodii sulphatis	5.00 (3 ii gr. xv),
Sol. sodii chlor.	(1:100) 250.00 (fl. 3 viii).

It should be used warm, four or five times daily.

### Solandrine.

A new alkaloid which has been isolated from *Solandra lavis* by Petrie (*Chem. and Drug.*, 1908, p. 14). It belongs to the atropine group and resembles *hyoscine*, but differs from it and its aurochloride in not changing the color of red litmus or phenolphthalein and in yielding atropic acid instead of tropic acid when hydrolyzed. Thus far the exact composition of the new alkaloid has not been determined.

### Solution of Chlorinated Soda, U. S.

*Labarraque's solution.*

An aqueous solution containing *sodium hypochlorite*, *sodium chloride* and *sodium carbonate*, with about 2.5 per cent. of available chlorine. It is a pale-greenish liquid with a chlorine odor and a disagreeable, alkaline taste; powerfully germicide. It is used like *chlorine water* (q. v.) as an ocular disinfectant in one to three per cent. mixtures with water. As an antiseptic irrigating fluid—especially when there is much muco-pus—it should be employed warm in the proportion of one part to fifty of water.

### Solveol.

This is a brown, transparent, oily, alkaline liquid, miscible with water, containing about 25 per cent of free cresol and 75 per cent. of sodium cresol.

This antiseptic is used as a detergent germicide in which instruments may be safely immersed. Burchardt advises 1 part of lysol, 2 parts of solveol and 1000 parts of distilled water as an effective disinfectant which does not affect cutting instruments. It is much less poisonous and more effective as a disinfectant than carbolic acid.

### Sophol.

A silver compound of formaldehyde with nucleinic acid. It readily yields formaldehyde. A yellowish-white powder, easily soluble in water,

Sophol is an antiseptic intended to displace silver nitrate and in solutions up to ten per cent. is recommended in *purulent*, particularly *gonococcic*, *conjunctivitis*.

According to the *Ophthalmoscope* (August, 1908), this latest silver substitute, a recent product of the Bayer firm, is a form-

onucleinic compound which contains 22 per cent. of the metal in what is called by chemists the "masked form." It is extremely soluble in water. This non-irritating and efficient product is recommended especially in the prophylactic treatment of newborn infants' eyes. v. Herff had one early infection, believed to have been of ante-partum origin, among 1050 infants treated with sophol—a low percentage of 0.095. E. Gallatia finds that sophol causes no silver catarrh, as does silver nitrate. It kills gonococci, keeps well, and causes but slight irritation. It is put up in 0.25 gramme tablets, of which one, dissolved in 10 c. cm. of cold water, makes a suitable strength for application to the eyes. Schiele praises a 5 per cent. solution of sophol in the treatment of acute trachoma. Bock employs a 5 per cent. solution in all affections of the conjunctiva accompanied by profuse discharge and due to micro-organisms. Sidney Stephenson has used a cold 5 per cent. solution of sophol under conditions for which one ordinarily employs argyrol—in the various forms of conjunctivitis, affections of the tear passages, etc. In his experience, it has proved as efficient as it is non-irritating. Indeed, clinically there seems a great resemblance between its action and that of argyrol.

Merck in his *Annual Reports* for 1908 says von Herff confirms his first findings on the efficacy of the preparation in *ophthalmia neonatorum*. He uses a .5 p. c. solution obtained by placing the preparation on the surface of the requisite amount of cold water contained in a glass or porcelain basin, and allowing it to dissolve by itself. This solution must be protected from light, otherwise partial decomposition takes place and gives rise to inflammatory action when it is used. One or two drops of this solution are instilled. With this treatment the author obtained considerable improvement in the ophthalmia.

While v. Herff prefers sophol to protargol, J. W. Selenkowski\* has come to the opposite conclusion. In his experience the bactericidal powder of protargol is greater than that of sophol. Dor\*\* regards both preparations as equally efficacious, but prefers sophol as being less irritant.

#### **Soziodole.**

*Soziodolic acid.* (See *Sodium soziodolate*.)

#### **Soziodole-Zinc.**

*Zinc soziodolate. Zinc düodopara-phenosulphonate.*

It occurs as colorless, odorless, needles, soluble in 25 parts of water; also dissolved by glycerine and alcohol. It is a powerful anti-

\**Praktitscheski Wratsch*, 1907, No. 24.

\*\**Réportaire de pharmacie*, 1907, No. 10.

septic and astringent and in ocular therapeutics has been used in cases where soluble zinc salts are indicated, chronic conjunctival catarrh, angular conjunctivitis (q. v.) etc., in one-fifth to 2 per cent. solutions; in salve form a little stronger.

### Sphagnol.

A native tar product said to be produced by the decomposition of peaty deposits. It resembles *thiol*, *isarol* and *ichthyol* (q. v.). As an ointment in *blepharitis* it is recommended in 10 per cent strength.

### Spiritus Etheris Nitrosi.

*Sweet spirits of nitre.*

This remedy is not commonly employed in ophthalmic therapeutics. Valk uses it in *collyria containing silver nitrate* (q. v.) He dissolves 5 grains of pure crystals of nitrate of silver in six drachms of distilled water and then adds two drachms of sweet spirits of nitre. This solution will keep much better than the usual solutions, as it does not tend to precipitate the oxide. He believes the free nitrous acid in the sweet spirits of nitre tends to keep the silver in a nascent state and in this way he thinks we get better effect than from the usual solution even when used in much stronger proportions. Furthermore, this solution does not require neutralization with the salt solution, as he has never noticed any untoward effects from its very free use even in the eyes of young children.

H. V. Würdemann employs it in an evaporating solution, which he applies on lintine after silver, copper or other irritating remedy:

R

Sod. bicarb.	2.50
Spt. etheris nitrosi.	4.00
Aquæ camph.	100.00

This well-known agent is rarely employed as a topical remedy in eye diseases, However, E. M. Alger (p. c.) uses it as an adjunct to collyria in from 5 to 10 per cent. mixtures and does not find it irritating.

### Stovaine.

This complicated organic compound occurs as small, brilliant, crystalline scales that melt at 347° F. (175° C.) and are very soluble in water. It is quite stable and its solutions may be sterilized at 115° C. without decomposition.

Of the *substitutes for cocain as a local anesthetic* this agent comes to us highly recommended, especially by Santos Fernandez (6). Its use should be limited to subconjunctival and subcutaneous injections

as in instillations it is not as effective as cocain. It is less than half as toxic as cocain. On account of its vaso-dilating property it should always be preferred to cocain in injections, as the latter, a vaso-constrictor, even though used cautiously, may produce precordial anxiety and pallor of the face, against which one is completely guarded if stovaine is employed. One may operate while the patient is sitting upright without fear of syncope. It is commonly used in the eye as instillations in four per cent. solution; for hypodermic or subconjunctival purposes in 0.75 to 1 per cent. aqueous solution.

Darier (*Thérapeutique Oculaire*, p. 86) believes that this agent is but slightly toxic and when given hypodermically does not act as a depressant. On the contrary it is a heart tonic, augmenting the intensity of its contraction. As a local anesthetic it is, perhaps, *in equal dose less effective than cocaine*; but in anesthesia by infiltration, the latter agent might easily be discarded for the same percentage of stovain. It is also a decided antiseptic.

The instillation of stovain solutions is *more painful* than that of cocaine. Darier uses with the very best results a mixture of *equal parts of acoine, stovaine and cocaine*, both for operation on the eye and for other purposes. He finds that corneal anesthesia is brought about most rapidly by the following mixture:

R

Adrenalin hydrochlor. 1:1000	gtt. x
Stovain.	
Cocain. hydrochlor. āā.	0.10
Sol. sodii chlor, (1 per cent.)	5.00

He believes it to equal cocain as a local anesthetic and advises its use in 2 to 4 per cent. solutions, which when boiled retain their power. It has a disagreeable odor, a bitter taste and is a feeblor mydriatic and cycloplegic than cocain. Like *alypin* (q. v.) it is a vaso-dilator. It acts as a decided irritant when combined with adrenalin in hypodermic or subconjunctival injections.

#### Starch.

*Amylum. Corn-starch. Amidon.*

In cases of blepharo-conjunctivitis with undue secretion finely powdered starch is, alone or with other agents, sometimes dusted on to the conjunctiva. In the same way it is recommended for true eczema of the lids and face. It is also employed like (or with) zinc oxide in ointments.

The starch bandage is a useful appliance in some operations upon and injuries to the eye.



**Streptococcus Serum.**

(See *Marmorek's serum* and the chapter on *Serum Therapy*.)

**Subcutin.**

This is an ethyl ester of para-amidobenzoic acid and occurs as a white crystalline powder soluble in 100 parts of cold and 40 parts of hot water. As a *local anesthetic* it is employed—generally in *hypodermic form*—in twelve and a half per cent. strength, dissolved in physiological salt solution. (See, also, *Anesthesin*.)

**Sublimate.**

(See *Mercury bichloride*.)

**Sublamine.**

Occurs as white crystals easily soluble in water and glycerine and contains about 44 per cent. of mercury. In collyria it is usually ordered in 1:5000—3000 solutions.

It is a mercuric ethylenediamine sulphate and is said by Blumberg (13) to have the greatest power of tissue penetration (with the minimum effect upon the skin) of all the mercurial salts. It is less poisonous than corrosive sublimate and its disinfectant quality is at least equal. Furthermore, corrosive sublimate frequently causes eczema of the skin, while sublamine does not. This is important, since exact experimentation has shown that the very slightest roughness, the most insignificant scaling of the skin, make an efficient disinfection of the parts more and more difficult. In this connection since, as Schleich, Gottstein, Haegler and others have shown, a sterile condition of the hands is the first desideratum in efficient operative work, and for that reason when a mercuric salt is employed for the purpose sublamine, even in concentrated solutions (in which state sublimate cannot be employed at all) is not contraindicated.

Imre,\* who made some of the earliest observations of this germicide investigated its value as a *conjunctival disinfectant*. He found it to be valuable in the various forms of *suppurative conjunctivitis*. In this connection he reminds us that regular cleansing of the conjunctival surface is the most important element in the treatment of these cases, *i. e.*, everything depends upon the frequent removal of the accumulated secretion. The earlier it is begun the greater is the likelihood that it will save the cornea. But even when begun late, irrigation is of the greatest importance. Though the noxious substances or bacteria under the conjunctiva or even in the corneal tissue cannot under these circumstances be reached by the fluid, it is always essential to prevent their

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\**Die Heilkunde*, Sept., 1903.

stagnation in the conjunctival sac. In some cases the fluid employed for irrigation is of no consequence; hence in chronic cases such as trachoma a 1 per cent. salt solution suffices. But in acuter cases, with abundant suppuration, as, for example, in gonorrheal conjunctivitis, a bactericide action is absolutely necessary. Abundant experience led him to affirm without hesitation that the disiccating action of simple irrigation fluids that are neutral as regards temperature and concentration, is by no means equal to that of really bactericide remedies. Unfortunately, however, there is no direct relationship between disinfectant power and therapeutic action; the sensitiveness of the conjunctiva must be reckoned with and chemical irritants avoided; for increased secretion in consequence of irritation much more than counterbalances their transitory good effects. Here a 1:1000 sublimine solution answers admirably, being readily borne and hardly causing prickling, redness or mucous secretion in the healthy conjunctiva.

In *acute gonorrheal conjunctivitis* the instillations were made every half hour from an undine onto the everted lids; where that was not possible the lids were opened as far as this can be done with the fingers or with retractors. 50 to 100 grams (1½ oz. to 3 ozs.) were used each time, and the treatment kept up day and night. Occasionally the instillations were made oftener, to obviate the stagnation of the pus; but experience has taught that too frequent irrigation, no matter with what, causes the formation of pseudomembranes. So for that matter do all other procedures, which occasion too rapid death and desquamation of the epithelial cells, cause hyperæmia and fibrinous exudation.

In other cases of severe infectious conjunctivitis, which are often caused by the Koch-Weeks bacillus, and generally in all cases of fresh catarrhs, sublimine compresses and irrigations are more effective than boric acid or the employment of lead or zinc. The secretion disappears more rapidly and the conjunctiva thins quicker. Painting with a weak nitrate of silver solution, or better with argentamine, must not be omitted; otherwise the later stages of the disease, when the violent irritative symptoms have disappeared, may be much protracted.

#### **Sugar.**

*Cane sugar. Sucrose. Saccharose.*

Pure-white, dry, hard crystals soluble in about half of their weight of water.

Mention has already been made of a mixture of this agent with calomel (q. v.) mercuric oxide and other agents as a *dusting powder* for the after-treatment of trachoma granulations. I

have also used fine powdered sugar alone for the same purpose and am aware that it has been recommended by others but, I fear, with no particular results. Its application is sometimes followed by pain, lachrymation and irritative injection of the bulbar vessels. Fuchs (60) advises the use of simple syrup in the treatment of *lime burns*.

As an astringent excipient L. D. Brose (p. c.) finds the following finely powdered mixture, dusted into the eyes morning and afternoon, followed by massage to be useful in chronic trachoma. The sugar has a distinct therapeutic value in the formula:

R

Pulv. sacchar, alb.	10.00
Pulv. cupri citratis	1.00

Gosselin also advises the application of syrup (sugar solution) for the relief of lime burns, but this practice is condemned by Parsons\* and others.

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\*J. H. Parsons. *Pathology of the Eye*, p. 1131, 1908.

# CHAPTER XXX.

## REMEDIAL AGENTS EMPLOYED IN THE LOCAL TREATMENT OF EYE DISEASES—CONTINUED.

*Sulphur—Suprarenaline—Suprarenin—Suprarenin Borate—Tannin—Tar—Thigenol—Thioform—Thiosinamine—Thyroid Extract—Tinctura Opii Deodorata—Tinctura Opii Crocata—Tincture of Iodine—Toluidine Blue—Tragacanth—Tropacocaine—Trikrisol—Tuberculin—Turpentine—Unguentum Aquae Rosae—Unguentum Glycerini—Unguentum Hydrargyri Dilutum—Unguentum Paraffini—Unguentum Rosatum—Unguentum Simplex—Uranine—Vaseline—Vasogen—Veratrine—Water—Wax—White Precipitate of Mercury—White's Ointment—Xeroform—Yellow Oxide—Yellow Precipitate of Mercury—Yohimbine—Zinc Acetate—Zinc Borate—Zinc Chloride—Zinc Iodide—Zinc Oxide—Zinc Permanganate—Zinc Salicylate—Zinc Salts—Zinc Sozoiodolate—Zinc Sulphate—Zinol.*

### Sulphur.

This polymorphic substance is found in a number of pharmacal forms; as yellow transparent *crystals*; yellow, solid, cylinders (*brimstone*); *precipitated sulphur* (*lac sulphuris*, milk of sulphur) as a fine, amorphous, pale-yellow powder; *sublimed* ("flowers" of) sulphur, fine, yellow powder with a faint odor, and *washed sulphur*, a fine, yellow, dry, tasteless, odorless powder.

The therapeutic activity of this agent is mostly confined to prescriptions for *scabies palpebrarum* and such skin diseases as acne of the lids. A useful ointment is:

R

Sulphuris pulv.	gm. 1.0 (gr. xv.)
Camphoræ	
Ol. olivæ āā	gm. 0.6 (gr. ix)
Ungt. simplicis	gm. 15.0 (℥ss)

Königstein uses a sulphur ointment with ammonium chloride to lids affected by styas. "Milk of sulphur" is present in Kummerfeld's lotion (q. v.) to the extent of 10 per cent.

In *chronic ulcerative blepharitis* L. D. Brose (p. c.) prefers the application of the following ointment. Before applying it the crusts are removed from the lid edges at night with tar soap:

R

Pulv. sulphur, precip.
Ol. cadini

Pulv. zinci oxidi	āā	1.00
Ol. olivæ		2.00
Lanolin.		9.00

### Suprarenaden.

This is the trade name of a preparation of the *suprarenal capsule* (q. v.) marketed by Knoll & Co. It has the same action as similar extracts of the adrenal glands and has been tested and recommended by a number of observers.

### Suprarenal Capsule and Its Derivatives.

(See *Adrenaline*, *Suprarenaline*, *Adrin*, *Suprarenin*, *Atrabilin*, *Epinephrine*.)

This hemostatic extract of the suprarenal capsule or gland is marketed by Merck as light, brownish particles that make a turbid solution with an equal weight of water. The solution should be *freshly prepared*, each time it is used, with sterile, distilled water in which case its *vaso-constrictor* and *styptic properties* are well developed. Although this method of obtaining the local effects of the adrenal bodies may not be as cleanly as the use of *adrenalin* (q. v.) and similar preparations, in my experience the blanching of the lid skin is more marked with the extract.

### Suprarenaline.

This is a *suprarenal capsule derivative* that closely resembles adrenaline chloride and is marketed by Armour & Co. It has, in my hands, furnished admirable results as an astringent and hemostatic. It is one of the more recent adrenal extracts and is marketed in 1 to 1000 watery solution. It relieves the ordinary congestion of the vessels supplied to the anterior globar section and to the palpebral conjunctiva, "whitens" the sclera and is one of the most effective agents for giving a clear field in strabismus and other bloody operations on the eyeball. Moreover, it seems more stable than some other capsule preparations.

H. V. Würdemann (p. c.) uses the following collyrium for simple conjunctivitis and hyperemia of the lids:

R

Suprarenalin. (1-1000)	3.00
Sodii boratis	0.50
Chloreton.	0.06
Sol. sodii chloridi (75 per cent.) ad.	30.00

### Suprarenin.

This active principle of the suprarenal gland occurs as a gray-white, crystalline powder, very slightly soluble in water. It has the qualities and clinical properties of adrin and suprarenaline (q. v.) and is employed in the eye in the same doses. It may be said to be the

German equivalent of our *adrenaline chloride* (q. v.) It is used in ocular therapy in solutions of 1:10,000 to 1,000. Like other suprarenal derivatives it should not be exposed to light. The *suprareninum hydrochloricum* of the Höchstler Farbwerke is a sterile 1:1,000 solution without a preservative, being dissolved in normal salt solution. It is cheaper than the corresponding adrenaline chloride solution and is said to be miscible with cocaine, eserine, atropine or zinc sulphate, without producing decomposition.

#### **Suprarenin Borate.**

White crystals, of which 1.3 grm. contains a gramme of pure suprarenin. It is *very soluble in water* and for that reason is often to be *preferred to suprarenin* which dissolves with difficulty. It has all the vasoconstrictor and hemostatic qualities of the *suprarenal glands* and is generally employed in conjunction with local anesthetics in eye surgery. It is also marketed in a sterile solution corresponding to the 1:1000 standard solution of suprarenin (q. v.).

#### **Suprarenin, Synthetic.**

##### *Methylaminoalcohol.*

According to the reports of the proprietors (Farbwerke Hoechst-am-Rhein) the action of suprarenin synthetic is a little more pronounced than that of suprarenin obtained from suprarenal bodies, evidently due to its absolute chemical purity. It causes a rise in blood pressure, *vascular constriction, dilatation of the pupil*, and diuresis with elimination of sugar identical with that from the natural product. A comparative examination made with the synthetic and natural suprarenin concerning toxicity showed exactly corresponding results.

It is a nearly white, fine granular, inodorous, crystalline powder, almost insoluble in water, alcohol and ether. Fuses at 207-208° C. The chemical and pharmacodynamic examinations of this preparation prove it to be *completely identical with the suprarenin* prepared from the suprarenal gland. In physiologic action it is more certain than suprarenin prepared from the glands, because of its absolute chemical purity. Its action as a vasoconstrictor, blood-pressure raising and pupil dilatant is identical with suprarenin prepared from the animal gland. Comparative experiments between the synthetic and the natural suprarenins demonstrated them to be identical in their toxic properties. The tests of identity of the synthetic product are identical with those of suprarenin from the natural gland. However, with oxalic acid, the synthetic base forms a well-defined crystalline salt which is stable in the air.

With hydrochloric acid, the base forms a well-defined crystalline salt, stable and readily soluble in water.

Suprarenin synthetic hydrochlorid is marketed in glass tubes con-



taining 0.06 grm. and 1.2 grm. each, as well as in sterile solutions 1 to 1,000 in 1-ounce bottles and in sealed ampules containing 1 c.cm.; in hypodermic tablets, tubes of 20 tablets 1/200 gr. each. In combination with the local anesthetic novocain tubes of 20 tablets No. 1 suprarenin synthetic hydrochlorid 1/200 gr., novocain 1/3 gr.; No. 2, suprarenin synthetic hydrochlorid 1/400, novocain 1/6 gr. It is used in conjunction with local anesthetics for local anesthesia, rendering the parts bloodless; also in episcleritis, *spring catarrh*, chronic conjunctivitis, iritis, *glaucoma* and in operations.

### Supranephran.

Another organic preparation derived from the suprarenal glands which is employed in a solution of 1:1000. The remedy has a marked effect in elevating the blood-pressure and in all respects resembles adrenaline and similar agents.

### Tannin.

*Tannic acid. Gallotannic acid. Digallic acid.*  $C_{14}H_{10}A_6$ .

An organic acid obtained from nutgalls. It is a shiny, faintly yellow, amorphous bulky powder, odorless but with an astringent taste. Very soluble in water, glycerine and alcohol.

This is an astringent agent that is comparatively little used because of its irritating action and because it has been supplanted by more efficient remedies. As the *glycerine of tannin* interest in it was, some years ago, revived for painting the granulations of trachoma. In simple, chronic conjunctivitis with thickening of the membrane Michel (65) advises its application as an ointment, 1:30, in petrolatum. Fick prescribes a watery solution of the same strength, to be used as a collyrium under the same circumstances, while other writers have regarded it with favor in diseases of the conjunctiva with undue secretion of pus or muco-pus.

In the *chronic forms of conjunctivitis* A. C. Rogers (p. c.) prefers the following combination:

R

Acid. boric.	gr. xv
Acid. tannic.	gr. i
Glycerin.	fl. 3i
Aquæ camph.	fl. 3i

Byron B. Viets (p. c.) uses this remedy in solutions of 80 *grains to the ounce*, which he also gives to patients suffering from *trachoma*. He advises that a few drops of a weak solution of cocain be distilled into the eye before using the tannin.

### Tar.

*Pix liquida. Resina empyreumatica liquida.*

Obtained by the destructive distillation of various pine woods.

It is a thick, viscid, semifluid, black-brown mass with an unpleasant odor and sharp, bitter taste. Tar is a variable and complex organization containing acetone, acetic acid, phenol, methyl alcohol, cresol, etc.

In the form of ointment it is used in *squamous blepharitis* and other dermal affections of the lids. One of the best formula I know is that with white precipitate:

R

Hydrarg. precip. alb.	0.5 (gr. viiss)
Petrolati	2.0 (3 ss)
Picis liquidæ	8.0 (3ii)

Mix thoroughly.

### Thigenol.

This rival of *ichthyol* is a mixture of sulphur and soda in oil. It is given a place here because of its curative value in the *severer forms of blepharitis marginalis*, especially the ulcerative varieties. It is a dark-brown, odorless compound quite soluble in water, glycerin and alcohol. No ill effects upon the ocular structures are reported from its prolonged use. It is obtained in solution from organic sulphur after the reduction of sulphuric acid by means of oil of sweet almonds. It can be incorporated with vaselin, lanolin, etc. The actions of the drug are antiseptic and analgesic. Fortunati (5) recommends it for eczema of the lids in ointments of 5 to 10 per cent.; blepharitis maginalis 10 to 50 per cent.; blepharitis ulcerosa, 10 per cent. It is applied to the edges of the lids, while gauze smeared with the salve, from 10 to 60 per cent., should be left on all night. The next morning after these applications the lids are carefully cleansed with an alkaline solution and pure thigenol used. The results of this treatment are excellent, a cure sometimes resulting in 25 to 40 days.

In *phlyctenular keratoconjunctivitis* the drug is useful in 5 per cent. solutions. Deep ulcer of the cornea yields to a solution in glycerin, 10 to 50 per cent. The pain is relieved and usually the ulcer begins to undergo repair in 5 to 6 days. In different forms of infective conjunctivitis the drug is used in 3 to 5 per cent. solution.

Del Monte (*Archivio d'Ottalmologia*, November, 1905) found thigenol to be of great service in *dacryocystitis*, *conjunctivitis* and *keratitis*. He believes it to be useful in 10 per cent. solution for irrigating the lachrymal passages after operation; in all kinds of blepharitis it has a beneficial effect and its action may be considered as specific in the forms kept up by epiphora. The agent is efficacious in *herpes of the conjunctiva and cornea*, especially when accompanied by marked irritation and watering. Thigenol in the last two mentioned

diseases is preferable to the red precipitate and the yellow oxide of mercury, because it causes no irritation and does not easily deteriorate in the form of ointment. Corneal ulcers do not contraindicate its use.

### Thioform.

*Basic bismuth dithiosalicylate.*

A yellow-brown, odorless powder, insoluble in water, containing 72 per cent. of bismuth oxide. This antiseptic is one of that numerous class of bismuth compounds recommended as a protective and dusting powder in place of iodoform. It is employed in substance and is conveniently applied by means of an insufflator or a camel's-hair brush.

In *Hare's System of Therapeutics*, will be found, in the chapter written by me, the observation that in *acute cartarrhal conjunctivitis*, when there is much secretion, finely powdered thioform acts very nicely when flecked upon the previously cleansed conjunctiva.

### Thiosinamine.

*Allyl sulphocarbamide. Allyl thiourea. Rhodalline.*

This is a complicated organic compound made by warming together volatile oil of mustard and alcoholic solution of ammonia. The product forms colorless crystals with an odor of garlic and a bitter taste. It melts at 74° C. (165° F.) and dissolves in 3 parts of alcohol. It is moderately soluble in water but soon after decomposes. This decomposition is partly prevented by adding glycerin to the solution. The internal dose is 0.03 grm. to 0.1 grm. ( $\frac{1}{2}$  to 1½ grains) given in tablets or capsules, but its most effective mode of exhibition is as hypodermic injection, the dose ranging from 0.05 to 0.25 grm. (1 to 5 grains) in 15 per cent. alcoholic solution or 10 per cent. glycerin-water solution. Since this method is painful *fibrolysin* (q. v.) is a better form of subcutaneous administration.

Thiosinamin is stated by Pick to be of good service in thick leucomata. He prescribes a *subconjunctival injection* of 0.5 c. c. of a solution of 2 grm. of thiosinamin in 20 grm. of water and 4 grm. of glycerine, corresponding to 0.45 grm. of fibrolysin (1-5 of an ampulla) once a week. Brandenburg has also tried the preparation in the form of intramuscular injections in *corneal opacity following keratitis scrofulosa*, *keratitis purulenta*, *keratitis trachomatosa*, in chronic uveitis and chronic retrobulbar neuritis. Some of the patients said they could see better, but no appreciable improvement could be shown.

The success following the use of this remedy in softening and dissolving scar tissue led to its employment in similar conditions about the eye, as in lid scars, in *corneal maculae*, symblepharon, extensive pterygium, etc. Many favorable reports have been published on this subject. For example K. H. Grunert (58) found thiosinamine of

use in lupoid scars of the skin and in post-neuritic atrophy. In the former case, the author used a solution of 4 grm. (gr. 60) of thiosinamine in 8 grm. (gr. 120) of glycerine and 40 grm. (oz. 1 1-3) of water; in the latter case, the same solution with the addition of 0.2 grm. (gr. 3) of strychnine nitrate. Of this 1 cc. (m 16) was injected into the muscles, at first daily, then at gradually increasing intervals. The remedy acts by softening and diminishing post-neuritic connective tissue formations in the optic nerves. The addition of strychnine is only needed at the beginning of the treatment, for when once the improvement has come to a standstill, the improved condition may be maintained by means of thiosinamine alone. The author's statement that the condition invariably grows worse if the treatment be left off too soon is of some importance.

The results obtained by D. Bruno (59) by the use of *fibrolysin* (q. v.) in eye work are worthy of note. It acts beneficially in softening scar tissue in leucomata after the subsidence of keratitis with hypopyon. Well-marked leucomata, which seriously interfered with vision, he reduced to slight nebulae by injections of fibrolysin into the glutei, or into the back. These injections were found to be equally efficacious in cicatricial spots resulting from syphilitic iritis, and exudative choroiditis. In many cases they were useful in softening and loosening the scar tissue, and thus facilitating further treatment.

Suker has also published favorable reports on the use of thiosinamine in corneal scars, but I have not been able to obtain as marked benefits from its employment. He says that the cases in which thiosinamine is indicated are:

1. Corneal opacities from any cause whatsoever.
2. Cicatricial contractions of the lids following trachoma.
3. Certain intra-ocular inflammations, as exudative choroiditis.
4. Symblepharon.
5. Capsular opacities following cataract extractions (experimental).
6. Ectropion, especially cicatricial.
7. Plastic iritis.

Speaking of the mode of administration he remarks that opinions differ widely: "Some, like Black, Newton and others, prefer the hypodermatic injections, two or three times a week. Again others, as Tousey, Ruoff and Beck, give preference to the administration per mouth. The weight of experience is in favor of three-grain capsules once or twice a day. The hypodermatic injections are not very desir-

able, as the solution does not keep overly well. Not only that, but abscesses are prone to follow; this has been the writer's experience. For topical applications, a 10 per cent. ointment is the most efficient. The latter can be applied two or three times a day in conjunction with massage of the part."

"The idea of employing subconjunctival injections of thiosinamin for corneal opacities occurred to the writer but a short time ago. The fact that it is used locally for keloids led to the experiment. A 10 per cent. aqueous glycerinated solution was used. Of this 15 minims were injected three times a week after thoroughly cocainizing the eye. The injections are not painful, nor do they cause any great inconvenience."

J. L. Duncan (p. c.) has had excellent results from 1 grain doses (in capsules) three times a day in both *old and new corneal opacities*.

#### **Thyroid Extract.**

*Glandulae thyroideae sicca. Desiccated thyroid glands. Thyroidin.* The thyroid glands of the sheep freed from fat, cleansed, dried, and powdered. One part of the powder represents 5 parts of the fresh glands freed from fat. Contains iodine organically combined with other active agents. Dose, 0.12-0.6 Gm., 2-10 gr.

In addition to the employment of this remedial agent in the *internal treatment of exophthalmic goitre*, (q. v.) it is considered by Radcliffe (p. c.) to be of particular value in the *various forms of keratitis*. He advocated in a recent paper its use in these affections, commencing with a small dose, *one or two grains three times daily*, watching carefully the constitutional effect. He believes it to be of great advantage to use it early and even in cases where other drugs are properly indicated. While the physiological action of Thyroid is not fully understood, he believes it has a dual action; first, on the lymphatic system and, secondly, in increasing metabolism and nutrition. It undoubtedly increases the lymphatic action as a marked improvement was seen in his cases within the first four days beginning its use. Such rapid improvement would hardly be the result of an improved nutrition alone.

#### **Tiodine.**

The name given by Weiss\* to a combination of *thiosinamin with ethyl iodid*. The iodine content amounts to 46.49 per cent. It forms white crystals, which are readily soluble in water, but with difficulty in alcohol.

Tiodine may be used by subcutaneous, intramuscular or intra-

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\*Wien. med. Wochenschr., 7, 1907.

venous injection, also internally in pill form. It is rapidly absorbed, has no irritant effects, the injections are painless, and the stomach is not disturbed. For hypodermic injection, 1 c. c. of a 10 per cent. solution is employed; in the interval two pills of 0.1 gm. may be daily administered. The indications for tiodine include all cases where cicatrization is present and thiosinamine is indicated. Tiodine is dispensed in ampullæ and pills.

#### **Tinctura Opii Deodorata.**

This mixture is made from opium, benzoin, alcohol and water, and contains 1.25 grains of morphia in each 10 cc. It is said to be preferable for internal use to the ordinary tinct opii and is, presumably, superior to laudanum for instillations into the conjunctival sac. Since, however, the topical effects of morphia upon the ocular apparatus are at least doubtful we may ascribe any therapeutic action of liquid opium extracts to the alcohol they contain. (See *Opium*.) This tincture forms part of Scott's mixture (q. v.).

#### **Tinctura Opii Crocata.**

(See *Crocus*).

#### **Tincture of Iodine.**

(See *Iodine*.)

#### **Toluidine Blue.**

*Zinc-chloride double salt of dimethyl-toluthionine.*  $C_{15}H_{16}N_3 SCl \cdot ZnCl$ .

A dark-green powder soluble in alcohol; less soluble in water. An aniline dye-stuff occasionally used, like *methylene blue* (q. v.), in ocular therapeutics, generally in 1:1000 solutions which are of a deep blue color.

I am indebted to Clarence P. Franklin (p. c.) for the following notes on this remedy: "After ten years' use of this drug the statement seems warranted that it is a most *efficient remedy in muco-purulent conjunctivitis* and is practically a *specific for the Koch-Weeks and Neisser forms of the disease*. The usual ten days to two weeks' discharge of "*pink eye*" is reduced to four to six days and with this treatment there seems to be less chance of a fresh infection; at least the writer has never seen a return in any instance among many cases.

In *ophthalmia neonatorum* and *gonorrheal ophthalmia of the adult* the purulent process is markedly and rapidly lessened.

It is *to be used three times a day* (in 1:1000 solution, dropped into the conjunctival sac) and alternated with solutions of adrenalin and boric acid. This treatment has given uniform results with no untoward symptom except that, rarely, a patient of pronounced susceptibility complains of slight stinging on its first instillation.



*Abrasions of the cornea stain* with toluidin blue rapidly but less vividly than with fluorescein, thus failing to adequately take the place of the later chemical, except in that it may be more bactericidal and, therefore, more useful in protecting an open surface on the cornea.

In an *aqueous solution of one to one thousand* this black powder makes a vivid indigo-colored liquid and the strength seems to be enough for all practical purposes, while solutions diluted to one to four thousand seem too weak.

Although toluidin blue stains the skin readily, it is easily removed by water, so that there need be no hesitation in its use.

### **Tonogen.**

One of the numerous European succedanea of our *adrenaline*. It is commonly used in Hungary and is sold in the usual 1:1000 solution.

### **Tragacanth.**

*Gum tragacanth. Goat's thorn. Hog gum.*

The gummy exudate from a number of species of *Astragalus*. It is found as whitish, brittle, translucent, ribbon-shaped bands of a horny consistency; forms a cloudy, jelly-like mass in 50 parts of water; mostly composed of starch, bassorin and pectin. In ophthalmic practice it is usually employed for protecting the skin about the eyes, for the *treatment of fissures at the angles of the lids* in scaly and moist eczema of the latter, and as a vehicle for powders and salves. For these purposes Wolffberg (43) recommends the following formula:

R

Tragacanth.	5.0
Glycerin.	2.0
Aquæ dest. ad.	100.0

I can heartily endorse this simple mixture for the purposes mentioned and believe anyone using it will be pleased with the result.

### **Tropacocaine.**

*Benzoyl-pseudotropine.*

This alkaloid occurs as colorless crystals and is found in the leaves of *Erythroxylon coca*, the Java coca plant. It differs chemically from cocaine and has decided myriatic powers.

The hydrochloride is generally prescribed. It is *best combined with 0.6 per cent. sodic chloride* in 1 to 4 per cent. solution. It is cheaper, more stable and more easily sterilized than cocain, while its anesthesia occurs more rapidly and lasts longer. On the other hand, it is quite poisonous and not more than half a grain (gm. 0.03) should, on that account, be used for injection anesthesia.

**Trikresol.**

A mixture of ortho-, meta- and para-cresols from coal tar.

It was first recommended by E. A. deSchweinitz in 1894 and later as an ideal antiseptic, although its use as eyewater causes a slight burning when first exhibited. Jackson (24) employs it as a *base for solutions* of cocaine, eserine, most of the mydriatics, and even boric solution in some cases; but not for solutions of homatropin or atropin, when repeated instillations are required, since even the slight sensations and increased lachrymation are objectionable. He has found that a solution of 1 to 1,000 is free from the risk of making the eye worse in any respect, that it is an antiseptic solution that will at least keep itself clean, and that it has a distinctly germicidal influence when used to wash out the conjunctiva. Although the solution of 1 to 1,000 has a very noticeable smell of trikresol, this does not remain about the patient on whom it has been used.

It seems superior to carbolic solutions to lay instruments in, to keep them from contamination after cleansing. It is also superior to formaldehyde solutions, for this purpose, because it is not necessary to rinse the instruments coming from it in something else before using upon the eye.

**Trypsin.**

(See *Pancreatine* under *Internal Remedies*.)

**Tuberculin.**

(See *Serum Therapy*.)

**Turpentine.**

*Spirits of turpentine. Oil of turpentine. Galipot.*

An oleo-resin derived from several coniferæ; a greenish, translucent, viscid liquid with a peculiar aromatic odor and a hot, pungent taste, soluble in alcohol.

Turpentine is chiefly employed in local applications to the eye as a *stimulant to absorption of corneal opacities*. Königstein dilutes it one-half with almond oil for this purpose. A single drop is instilled into the eye which is then covered by a protective and the ensuing hyperemia watched. Undue irritation should be avoided, especially as the treatment may have to be continued for several weeks.

**Tulase—Behring.**

(See also *Internal Remedies*.)

Of considerable interest is the communication\* by v. Behring regarding *tulase*, his new remedy for administration in tuberculosis. This substance contains all the constituents of the Koch bacillus and forms a clear fluid which has the general outward characteristics of

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\*From Lehn and Fink's (1908) *Progress in Pharmacy and Therapeutics*.

thin honey. It is put up in one per cent. or ten per cent. solutions in glass-tubes, each containing 5 c. c., and may be given subcutaneously, intravenously or by mouth. In individuals free from tuberculosis, a condition of immunity is produced in about four months, but in infected persons the effect is much more rapid. The administration of *tulase in milk* is the only manner in which the remedy can be given to infants as a prophylactic measure, and then it should only be given once or possibly twice with an interval of eight days in between. Much larger doses can be taken by adults *per os* than by the subcutaneous or intravenous methods. The initial dose is 0.01 c. c., which is doubled on four successive days. After an interval of from two to four weeks the administration is repeated in the same manner. Behring himself warns against placing too much reliance on the remedy at the present time. He believes that thus far there is no ground for assuming that tulase will actually effect a cure in advanced cases of tuberculosis, but he does claim that the preparation may be regarded as suitable for administration in the young subject as a purely prophylactic measure or as a means of favorably influencing the spontaneous healing by the natural resources of the organism of whatever tubercular foci may already be present in the system and to prevent any interference with the process by subsequent tubercular infections.

#### **Unguentum Aquae Rosae, U. S.**

(See *Cold cream*.)

#### **Unguentum Glycerini, P. G.**

(See *Glycerite of starch*.)

#### **Unguentum Hydrargyri Dilutum.**

*Blue ointment. Unguentum hydrargyri cinereum, P. G.*

Mercurial salve is often used alone or in conjunction with other agents as an application to the external eye. Its action is chiefly that of counter-irritant and derivative, and as such is occasionally used in scleritis, phlyctenules, etc. It is one of the ingredients of the popular Arlt's forehead ointment.

#### **Unguentum Paraffini, P. G. et Br.**

A simple, emollient unguent used as a base for salves or to be mixed with other ointments. It resembles our *petrolatum* (q. v.).

#### **Unguentum Rosatum, P. G.**

*Unguentum leniente.*

Another name for our "cold cream" or *Unguentum aquae rosae* (q. v.). It is employed like it as an excipient for other remedies as is this salve for *scabies ciliarum*:

℞

Sulphur depurati

i.0 (gr. xv)

Camphoræ

0.6 (gr. ix)

Olei olivæ

Unguenti rosati

āā 15.0 (3iij ss).

**Unguentum Simplex.**

*Unguentum*, U. S. *Unguentum adipis*. *Unguentum cereum*. *Simple ointment*.

This salve, generally used as a basis for other ointments, is made by gently heating together 1 part of white wax and 4 parts of benzoated lard.

**Uranine.**

*Uranine yellow*. (See *Fluorescein*.)

**Valsol.**

*Valsolum*.

These are oxygenated petroleums, like *vasogen* and *petrogen*, and are marketed not only pure but as containing definite amounts of ichthyol (10 per cent.); iodine (6 and 10 per cent.); iodoform (3 per cent.); tar (25 per cent.), and other preparations suitable for applications of the eye. They may be also made up with nearly every variety of medicament suitable for application to the skin.

**Vaseline.**

This is the registered name given to a useful and well known product manufactured by the Cheeseborough Co. A yellower compound, a part of the residue from the distillation of petroleum, is sold in Germany but as Ohlemann\* points out, is not so useful as the American variety as an ointment base because it contains and will absorb very little water. It is obviously of advantage to use a base that has solvent powers, and since vaselin in itself is non-solvent that variety which has or retains the larger proportion of water is to be preferred. The German variety is not as viscid as the American and breaks off short when raised on a probe, while the American may be drawn into long threads. The latter is very popular both here and abroad as an excipient. Some writers attribute germicide qualities to ordinary Cheeseborough vaseline; if so it probably acts by furnishing a protective coating to the tissues in which bacteria do not readily flourish. There is a purified or "white" vaseline in the market (*Cosmoline*) but I much prefer the cheaper variety not only as a basis for salves but for use alone as a soothing protective. The official *Petrolatum* (q. v.) answers all the purposes of vaseline and should for obvious reasons, be ordered under that title. (See *Cosmoline* and *Petrolatum*.)

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\*Loco. cit., p. 45.

### Vasenol.

A useful ointment-base for ophthalmic agents. It consists of an emulsion of *soft paraffin* 28 ounces, *cetaceum*  $\frac{1}{2}$  ounce, and *water* 8 ounces. It readily mixes with water, forming a neutral emulsion which is easily absorbed by the conjunctiva and skin.

### Vasogen.

*Oxygenated vaseline.*

This yellowish-brown, viscid mass, with an alkaline reaction, forms an *emulsion with water and renders many active remedies*, especially a number used in ophthalmic surgery, readily absorbable. Such a list includes *creolin*, *menthol*, *iodine* (see *iodine-vasogen*) *ichthyol* and *pyoktanin*.

The advantage vasogen possesses over even the watery forms of vaseline or petrolatum is in its solvent powers. It is said to be capable of absorbing 100 per cent. of water without losing its consistency. A sterile *liquid vasogen* is on sale as well as capsules containing various combinations of it with drugs for internal administration. Lehn and Fink, the agents for this preparation, also supply both the *pure or inspissated vasogen*, as well as the *liquid form*, in various combinations and doses for external use, several of which, especially those with *iodine*, *thiol*, *ichthyol*, *iodoform*, *salicylic acid*, *mercury* and *menthol*, are of interest to the ophthalmologist. See, also, *petrogen*.

### Veratrine.

An alkaloid (or rather a mixture of alkaloids) obtained from the seeds of *Asagraea officinalis* and other plants. It is a grayish-white, odorless, amorphous agent with an acrid taste that leaves a numb feeling in the mouth and sets up violent sneezing if even a minute particle reaches the nose. It dissolves in 1,750 parts of water; very soluble in alcohol, ether and chloroform.

This powerful alkaloid is occasionally useful in the form of the *ointment* (U. S. one per cent.) when applied for the relief of ocular neuralgia. Coccius used it to relieve the pain of iritis as a *one or two per cent. mixture with vaseline*. A piece the size of a pea should be placed on a piece of cotton and rubbed along the course of the affected nerve. This may be repeated two or three times daily if required. Toxic symptoms have followed even this mild inunction, so that great care should be observed in using so poisonous an agent.

Theobald (*Text-book*, p. 515) prefers the oleate in 10 per cent. strength to any other preparation of the kind in *asthenopia* and *frontal headache due to accommodative strain*. He also employs it to lessen the irritability of the ciliary muscle preparatory to testing errors of re-

fraction. A little is to be rubbed upon the forehead and temples once a day, preferably in the morning. None of it should be allowed to enter the eye, as it causes severe and persistent irritation.

#### **Vernisol.**

A skin varnish, soluble in water in the form of a jelly which dries and leaves a transparent, flexible coating, non-irritating. It is a satisfactory substitute for collodion and may be medicated.

#### **Walnut, English.**

*European walnut. Nux regia.*

The leaves and green shells of *Juglans regia* are used in medicine. They contain *tannin*, a *volatile oil*, *mucin* and extractive matters. A decoction of the shells has for many years been popular in Europe as an application to "sore eyes"—*acute* and *chronic blepharoconjunctivitis* especially. In the same way a few drops of the fluid extract, diluted with 10 to 50 times their weight of water, have been prescribed as a *lotion* in all forms of *conjunctivitis*.

#### **Water.**

*Aqua fontana. Aqua pura. Aqua destillata. Spring water.*

Generally contains carbonic dioxide in solution, so that it dissolves many calcic and magnesian salts from the soil. Such water precipitates soap and, hence, is called *hard* water. *Rain water* and *snow* water are generally free of soil contaminations and are termed *soft* water. *River water* contains little carbon dioxide and is generally soft.

Water for use in ophthalmic therapy should, as a rule, be *distilled* and *sterile*.

One must not forget the employment of *water* as a *topical application* apart from its use as a carrier of heat and cold. The rule that *pure* water in douches, irrigations or sprays is not a proper fluid, or is less irritant than normal salt, one per cent. boric acid, or other bland solution for flushing or cleansing mucous membranes, to some extent applies to the conjunctiva. Yet tepid (100° F.), sterile douches of distilled water act well in washing out the sac and are most soothing to the eye, particularly in the presence of mucus, pus or toxins. It does not appear, when judiciously used in an undine (q. v.), with a medicine dropper or in a small irrigator, to increase the muco-purulent secretion.

Thompson claims that in prescribing collyria *filtered water* is better as a diluent than distilled water since the latter acts injuriously on epithelial cells.

J. A. Lippincott applies *hot water* (150° F.) *drop by drop* to the *cornea* in ulcer of that organ. This acts both as a stimulant and antiseptic and is also employed as a satisfactory remedy by many ophthalmologists.



Its employment as an excretory adjuvant in the internal treatment of disease has received attention elsewhere. See Index.

# **Wax.**

*White wax. Yellow wax. Cera, U. S. Cera citrina.*

A solid, yellow or white substance obtained from the honeycomb of the bee. White wax is merely yellow wax bleached by exposure to light and air or (improperly) by means of chlorine. There are also numerous vegetable waxes. Wax is mostly employed in making *cerates* and is an adjunct to salves. An example is:

℞

Hydrargyri oxidi flav.

0.2 (gr. iij)

Ceræ alb.

1.5 (gr. xxii)

Misce et fiat unguentum.

# **White Precipitate of Mercury.**

(See *Mercury, white precipitate of.*)

# **White's Ointment.**

The problem of obtaining the complete antiseptic action of sublimate (q. v.) upon the ocular tissues without disturbing unduly the vascular supply of the parts and without inducing discomfort, is solved by the use of a formula proposed by J. A. White. He found that while it is impossible to use, especially in operative work, such *decided germicide solutions* as 1:3,000 in water that strength might be employed as an ointment with vaselin. His formula is:

℞

Hydrarg. bichlor.

gr. 1/6.

Sodii chlor.

gr. 5/6

Alcohol dil.

q. s.

Petrolati

5j

Dissolve the sublimate and the common salt in a few drops of dilute alcohol and mix with the vaselin, which has been previously kept at a temperature of 212° F. for half an hour. Stir until cool. This may be put into soft capsules for individual use, or kept as an antiseptic base for atropine and other ointments. I have prescribed this salve and used it extensively in private, dispensary and hospital work and can recommend it as a most useful application to the sac when a reliable antiseptic is desired. It is my practice to fill the sac with the ointment twice in 24 hours as one of the preliminaries to major operations on the globe. I also prescribe it extensively alone and in conjunction with other remedies for the home treatment of several forms of blepharitis.

J. A. Lippincott, (p. c.) *advises a modification of the ointment,*

especially in infected ulcers of the cornea, *by the addition of lanoline*, which takes up the watery solution of the bichloride better than vaselin alone. His formula is as follows:

R

Hydrarg. bichlor.	gr. i
Sodi chlor.	gr. vi
Petrolati	ʒii
Lanolin.	ʒiii

#### Witch hazel.

(See *Hamamelis*.)

#### Xeroform.

*Bismuth tribromocarbolate. Bismuth tribromophenate.*

It is a yellow, insoluble powder, neutral, odorless and tasteless; containing about 60 per cent. of dibismuth trioxide.

I have found this remedy a valuable substitute for iodoform. I especially in wounds of the lid and as a dressing after orbital operations, where the former agent is especially offensive, as, indeed, it usually is, especially to the patient operated on. I have also employed it, with satisfaction, as a dusting powder, or applied with an insufflator, in corneal ulcer.

In *phlyctenular keratitis* Ray H. Dean (p. c.) uses it as a *dusting powder* not only to the cornea and conjunctiva but on the skin surface of the lids. He also employs it where iodoform powder is usually required. In the form of dry xeroform gauze applied to the eye with a bandage he finds it of great value as an antiseptic dressing.

#### Yellow Oxide.

(See *Mercury, Yellow oxide of*.)

#### Yellow Precipitate of Mercury.

(See *Mercury, Yellow oxide of*.)

#### Yohimbine.

Mostly in the form of the *hydrochloride* as white crystals.

This alkaloid is derived from the *yohimbe* tree of West Africa. Claiborne and Coburn (2) speak of its value as a *local anesthetic*; it occurs as white, silky crystals, readily soluble in alcohol, but soluble in water only to the extent of 2 per cent. The hydrochloride is the salt usually employed; its aqueous solution deteriorates rapidly and after a week cannot be relied upon; it may, however, be preserved much longer by the addition of a small amount of chloroform. It has been proven non-toxic when injected in doses of 25 cc. of a 1 per cent. solution.

The following conclusions are recorded by the authors: 1. A 2 per cent. solution of yohimbin, either alone or in equal mixture

with adrenalin chlorid 1:1000 solution, dropped into the conjunctival cul-de-sac five or six times in ten or fifteen minutes, will produce both corneal and conjunctival anesthesia. Marked anesthesia of the cornea lasts from thirty to forty-five minutes after the last instillation; the conjunctival anesthesia is at no time so profound as the corneal, and disappears several minutes before the latter. 2. There is a slight stinging sensation immediately following the instillation which becomes less and less with each instillation, finally disappearing altogether. 3. The eye becomes immediately suffused and continues red for more than an hour after the last instillation. 4. There is no widening of the palpebral fissure. 5. There is a moderate dilatation of the pupil which comes on several minutes earlier after the last instillation with adrenalin and yohimbin in combination than with yohimbin alone; this lasts in either case from fifteen to twenty minutes. 6. The slight blurring of vision for far and near appears to be due to spherical aberration rather than to paresis of accommodation. Yohimbin alone or in combination with adrenalin is an exceedingly mild mydriatic. 8. Adrenalin when mixed in equal parts with yohimbin in 2 per cent. solution loses its constricting power upon the blood vessels of the palpebral and bulbar conjunctiva. 9. The last mentioned fact suggests the idea that yohimbin may be an antidote to adrenalin chloride. 10. In view of the congestion caused by yohimbin, it cannot be considered the ideal anesthetic for operations involving the conjunctiva or muscles. 11. As an anesthetic in cataract extraction and in iridectomy it would probably be effective. 12. On account of the congestion produced by it, yohimbin is inferior to cocain as an anesthetic in all operations of the eye.

#### **Zinc Acetate.**

*Zincum aceticum*, P. G.  $\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2$ .

Made from commercial zinc oxide, acetic acid and water, and is found in pharmacy as white, soft, pearly scales or plates with an acetous odor and sharp, metallic taste. It is very soluble in water; less so in alcohol.

Owing to its solubility it is useful in collyria and may be used, like the sulphate and chloride, where zinc salts (q. v.) are required. A solution containing a half to two grains to the fluid ounce of water is the usual collyrium for chronic conjunctivitis.

A mixture of zinc acetate 1 part and alumnol (q. v.) 4 parts has been recommended as a good antiseptic. Its trade name is *Zinol*. I have had no experience of this remedy but it is reported to be useful in the Morax-Axenfeld and other forms of conjunctivitis in one-fourth to one per cent. aqueous solution.

**Zinc Borate.**

*Zinc tetroborate. Zinc biborate. Zinc pyroborate.*  $\text{Zn B}_4\text{O}_7$ .

This is a white, amorphous powder, very little soluble in water. It is used like zinc oxide as a dusting powder and in 10 per cent. salves in eczema of the lids and in mild forms of blepharitis. When collyria containing zinc sulphate are ordered with free boric acid small quantities of the borate are probably formed.

**Zinc Chloride.**

*Zincum chloratum*, P. G.  $\text{Zn Cl}_2$ .

A whitish, crystalline powder, or it is found as opaque tablets or rods; very deliquescent. It is odorless, has a very caustic taste and is soluble in less than half its weight of water.

In addition to the use of this agent as a *paste for escharotic purposes* in the treatment of warts, malignant tumors and granular tissue about the eye and for the destruction of the lachrymal sac, it is by some surgeons employed in weak solutions, (one-fourth of a grain to the ounce or 1:500 to 2,000) as an antiseptic and astringent in affections (especially the conjunctivitis) of the external eye. In common with the milder zinc salts it is almost a specific in the Morax-Axenfeld infection. Burgeois (50) and others regard still stronger solutions (1:100 to 20) as of great value for injecting the lachrymal sac in dacryocystitis, especially when that disease is complicated with corneal ulcer.

Gifford (p. c.) advises brushing or swabbing the everted lids in *gonorrhæal ophthalmia* with a 2 per cent. solution of zinc chloride instead of silver nitrate. He exercises care not to have the solution run into the sac and believes that employed in this fashion twice a day it is superior to the silver salts as an anti-gonococcic remedy.

**Zinc Iodide.**

*Zincum iodatum*, P. G.  $\text{Zn I}_2$ .

This is a white, granular, odorless crystalline powder, with a sweetish but sharp metallic taste. It is very deliquescent, decomposes readily and soon acquires the taste and smell of iodine. It is soluble in water and alcohol.

Iodide of zinc is astringent and antiseptic and may be employed like other zinc salts (q. v.) in the treatment of various external diseases of the eye. Its usual dose is one-fifth to one per cent. in water.

Webster Fox (*Text-book*, p. 554) gives the following formula for use, twice daily, in *ophthalmia neonatorum* with marked oedema of the eye-lids. Iced, cotton pledgets are to be soaked in the solution and applied to the closed lids:

$\mathcal{R}$

Zinci chlor.

0.259 (gr. iv),

Acidi borici.	0.775 (gr. xii),
Tr. belladonnæ	
Vini. opii.	āā 7.39 (f. 5ij),
Aquæ camph.	
Aquæ dest.	āā 60.00 (fl. 3ii)

### Zinc Oxide.

#### *Flowers of Zinc. Zn O.*

A faint, yellowish-white, amorphous powder, insoluble in water.

This preparation of zinc used alone is practically inert except that it forms a *useful protective* where the epithelium is removed from the skin or a mucous membrane. Mixed with oily substances or incorporated with salves it is a useful adjunct and as such does good service in various forms of *blepharitis* and *eczema of the lids*. For this purpose it mixes well with *ichthyol*, starch and petrolatum, the most useful proportion with the last named being from 2 to 10 per cent. Fick's formula for moist, eczematous patches on the lids probably produces some zinc salicylate:

℞	
Zinc oxidi	1.0 (gr. xv)
Acid. salicylic.	0.1 (gr. iss)
Vaselini	10.0 (3iiss)

In *chronic ulcerative blepharitis* L. D. Brose (p. c.) prefers the application of the *following ointment*. Before applying it the crusts are removed from the lid edges at night with tar soap:

℞	
Pulv. sulphur. precip.	
Ol. cardini.	
Pulv. zinci oxidi	āā. 1.00
Ol. olivæ	2.00
Lanolin.	9.00

### Zinc Permanganate.

#### Zn (MnO<sub>4</sub>)<sub>2</sub>.

This salt occurs as dark violet-brown, hygroscopic, crystalline granules, similar in appearance to permanganate of potassium and, like it, used as an antiseptic and astringent wash. It is employed as a bactericidal collyrium in 1:1000 to 500 solutions and should from its chemical composition be very useful clinically. I have prescribed it with much benefit as a 1:3,000 solution for the home *irrigation of the nasal duct* following operation for the relief of lachrymal stricture.

### Zinc Salicylate.

This salt crystallizes in long, satiny needles with a sweetish, styptic taste. It is soluble in 20 parts of cold water; more soluble in alcohol and ether.

As a collyrium it is occasionally used in purulent ophthalmia and chronic catarrhal conjunctivitis, especially in the Morax-Axenfeld variety, as an astringent and antiseptic. Collyria are generally made up with 1 to 5 grams of the salt to the fluid ounce of water.

### Zinc Salts.

Several of these are used in ophthalmic surgery and are prescribed either directly as such or are ordered in such chemical combinations as produce them. They are all valuable astringents and when judiciously employed (weak solutions and ointments for Americans!) are of signal value especially in most forms of subacute and chronic conjunctival catarrh. The chief compounds from the ophthalmic standpoint are the sulphate, chloride, borate, oxide, acetate, salicylate, sozoiodolate, iodide and permanganate, all of which are separately discussed in the alphabetical list of drugs. All of them, as has been frequently remarked, act as specifics in diplobacillary or angular conjunctivitis.

Most soluble zinc salts are *incompatible* with alkalis, cyanides, lime water, sulphates, sulphides, and nearly all the vegetable, astringent decoctions and infusions.

A. Duane (p. c.) uses *zinc chloride* or *zinc sulphate* in varying degrees of concentration, either alone or combined with boric acid, in *chronic conjunctivitis of unknown origin*, when an astringent effect seems desirable, and, of course, in *diplobacillus-conjunctivitis*. On the whole he has been disappointed in the action of zinc in conjunctival catarrh and finds many people who cannot bear it even in very weak solutions. A favorite combination with him is:

R

Acid. boric.	
Sod. borat. ãã	0.50
Zinc. sulph.	0.06
Aquæ dest.	15.00

For the *relief of the smarting and occasional pain following the use of collyria* made with zinc sulphate, zinc chloride and other soluble zinc salts H. V. Würdemann, (p. c.) advises the addition of  $\frac{1}{2}$  per cent. *antipyrine* or *chloretone* to these mixtures.

### Zinc Sozoiodolate, P. G.

(See *Sozoiodole-Zinc*.)

### Zinc Sulphate.

*Zincum sulfuricum*, P. G. *Vitriolum album*. *White vitriol*.  $\text{Zn SO}_4 + 7\text{H}_2\text{O}$ .

This salt closely resembles magnesium sulphate (Epsom salts), occurring in large colorless crystals that slowly effloresce in air. It is very soluble in water; insoluble in alcohol and is an irritant poison.



The sulphate is generally regarded as the ideal zinc salt for ophthalmic use. It is prescribed in solutions of from one to 500 to two per cent. All the soluble zinc salts (q. v.) act as *specifics in the Morax-Axenfeld conjunctivitis*, but as they are decided irritants I hesitate to employ them in other conjunctival diseases except in the weakest solutions and generally in combination with other agents. In simple conjunctivitis a 1:1,000 solution in distilled water has, in my hands, proved quite strong enough. For such purposes as injection of the sac for dacryocystitis one to three per cent. solutions are recommended. Zinc sulphate is also used as a one per cent. ointment with vaseline and other bases.

In the various forms of catarrhal conjunctivitis Hirschberg uses plain solutions with distilled water, from 1:1,000 to 1:100, according to the desired astringent effects.

It may, of course, be combined with other adjuvants and correctives. For example:

℞

Zinc. sulphatis	0.5 (gr. vii)
Tinct. opii	1.0 (gtt. xv)
Aquæ dest.	150.0 (℥iv, ℥v)
Aquæ feniculi	50.0 (℥j, ʒjss)

E. A. Dial, (p. c.) suggests that if to *every pint of boric acid collyrium two grains of zinc sulphate* be added it would increase to its efficacy in *simple hyperemia and catarrh of the conjunctiva*.

For the *hyperemia of the conjunctiva and the irritative symptoms* that sometimes accompany refractive errors and occasionally persist after they have been properly corrected, Hanford McKee (p. c.) prescribes a *collyrium containing one-sixteenth of a grain of zinc sulphate to the ounce of water*.

#### Zinc Sulphocarbonate.

*Zinc sulphophenate. Zinc phenolsulphonate.*  $\text{Zn} (\text{C}_6\text{H}_5\text{SO}_4)_2 + 8\text{H}_2\text{O}$ .

Clear, colorless, columnar crystals, or fine, white powder, very soluble in water or alcohol. It is a stimulant-astringent and is occasionally employed in 1:200 of distilled water in infections of the anterior ocular segment, especially in chronic diplobacillus inflammations.

L. D. Brose (p. c.) advises the following mixture as a collyrium in *simple catarrhal conjunctivitis*, two drops to be put into the eye four times a day:

℞

Zinci sulphocarbonatis	0.02
Sol. adrenalin, chloridi (1.1000)	0.33

Acidi borici	0.13
Aquæ camphoræ	
Aquæ dest.	āā 4.00

**Zinol.**

(See *Alumnol* and *Zinc Acetate*.)

## CHAPTER XXXI.

### OCULAR HYGIENE. THE CARE OF THE EYES AND THE PRESERVATION OF EYESIGHT.

*Public Duties of the Ophthalmologist—Care of Infants' Eyes—Proper School Age—Care of School Children's Eyes—School House Sanitation—Regular Medical Examination of the Eyes of School Children—Proper School Books from the Viewpoint of Ocular Hygiene—Care of the Eyes in Adult Life—Injurious Reading Habits—Private House and Office Building Illumination—The Value of Various Means of Indoor Illumination—Prism Batteries—Hygienic Value of Yellow.*

Although it is not the purpose of this System to enter fully into this subject, a statement of the principles of personal and public hygiene as an addendum to the chapters by Frank Allport and Nelson Miles Black, may be of interest. For a more complete account of this interesting subject, so far as it relates to schools and school children, the reader is directed to the elder Risley's article in the Norris and Oliver *System of Diseases of the Eye*. The subjoined pages on this subject follow almost entirely, as do some others in this work, the Manual on the *Commoner Diseases of the Eye*, by Thomas A. Woodruff and myself.

#### **Public Duty of the Ophthalmologist.**

It need scarcely be mentioned here that it is *quite as important to conserve the eyesight as to restore it*. The application of those hygienic rules that have been formulated as the result of a study of ophthalmology is as necessary in the practice of the physician as regulating the dietary or any habit of his patient. Moreover, the family doctor will be constantly called upon to answer such questions as "What is the best light to use in reading?" "What do you think about the type of this school book?" "Would you advise us to send John to the kindergarten?"—all of which demand at least some acquaintance with ocular hygiene. It frequently happens, also, that the physician is elected to serve as school trustee or as a member of the school board; how can he intelligently fill such an office unless he is acquainted with the requirements of modern school rooms, with all their details of lighting, seating, painting, etc.?—matters of vital moment when one con-

siders that the eyes are the organs chiefly employed and involved in acquiring an education.

### **Infants' and Children's Eyes.**

Should never be exposed, even in sleep, to the glare of strong light, artificial or natural, and this is particularly imperative when the child is taken out in a perambulator or carriage. The eyes should then be protected by an awning or parasol lined with material that will not reflect the sun's rays upon the face.

They should not be encouraged to use their tender eyes for near work and their playthings ought to be large objects, easily seen. *Kindergarten and primary schools* should recognize this rule, so that the occupations of the child do not injure the eyesight. *No fine, difficult, or prolonged visual labor should be permitted* lest present eye strain be produced or a foundation for later myopia be laid. Sewing, map-making, perforated card problems, much reading, intricate drawing *et hoc genus omne* should be banished from every primary school. As Pyle properly observes: "If a child has red eyes, holds its book close, complains of not being able to see at a distance, looks at objects sideways or between partially closed lids, or squints or complains of headache, browache, or pain in the eyes, it is the parents' or teachers' duty to send it to a competent oculist. If the oculist decides that glasses are necessary, they should be put on at once in spite of any foolish prejudices, for they will save and promote the physical and intellectual development of the child and prevent many years of suffering and perhaps irreparable ocular disease."

The so-called "stupid" child is too frequently one who has defective eyesight, and in consequence appears inattentive to his studies; the adjective quoted might with great justice be applied to his guardians.

*The age at which a child should be sent to school* depends largely upon the condition of his visual apparatus. If he has no ocular defects, is otherwise in good health and is never "crammed" or made to study out of school hours, half a day's schooling may be commenced at seven or eight years of age by the average child. The amount of work may be gradually increased until at ten he does a full day's work.

*Children in poor health*, especially if they exhibit ocular or aural defects or show a tendency to myopia, or present evidences of eye strain, *should have little or no systematic schooling before they are twelve years old*. That child will be happier and a better citizen, as well as a more successful man of affairs, who develops into a fairly healthy, though imperfectly schooled, animal at twenty than if he becomes a learned, neurasthenic asthenope at the same age.

**School Houses.**

These should always be located and built with particular regard to the eyesight. Ocular defects are most numerous in poorly lighted, badly drained and improperly ventilated schools. The *window-space* should be at least *one square foot to every five of floor-space*. There should be no obstruction to the entrance of sunlight and the nearest buildings should be at least twice as far away as their heights. *Light should fall upon the pupils' desks from the left and rear* so that there never is any light thrown directly upon or directly reflected into their faces. In this way no shadows are cast by the hand and arm (of right handed pupils) upon the writing pad or paper. There should be no annoying cross lights, or windows in front. The top floors are best illuminated from overhead sky lights.

Myles Standish (*Ophthalmology*, Oct., 1908) regards as the *essentials of proper illumination of school rooms*:

1. The walls should be painted a very light color, preferably an exceedingly pale green or buff.

2. The wooden finish of the room and desks should be light in color.

3. The window shades should be able to exclude direct rays of the sun, diffuse daylight freely, and also in the evening reflect a generous proportion of the light which falls upon them.

4. Direct illumination is desirable.

5. The lighting stations should be so arranged that no annoying shadows shall fall on the pupil's desk.

6. The newer forms of incandescent lamps and Zalinsky shades, when properly arranged, can give a candle-foot illumination of 2.5 on each and every desk in the ordinary school room, and finally,

7. That in most cities the expense of electricity, used in the manner above described, is not so much greater than the cost of gas as to be prohibitive.

Even on cloudy days *it should be possible to read fine (diamond) print in any part of the school room* without the aid of artificial light; indeed, no artificial light is ever used in the ideal school room. A north light is preferable, but light from any direction can, at any time of the year, be regulated by shades and awnings, which are preferably of light colors—gray, buff, green or blue. Risley, our chief American authority on this subject, gives the following *dimensions of the ideal school room*:

Length of room ..... 32 feet

Width of room ..... 24 feet

Height of ceiling .....	15 feet
Window space (linear measurement) .....	24 feet
From floor to window-sills (beveled) .....	3 feet
Height of windows .....	11 feet

The room accommodates 45 pupils, giving 256 cubic feet to each. The *walls and ceilings* as well as the woodwork should be of the same softly reflecting colors as the window shades. The *desks* should be adjusted to the individual needs of the pupil and should be chosen with due regard to his comfort; the restless and uncomfortable pupil works the most mischief. If the seat is too high the child's feet are suspended in midair; if the desk is too high the elbows cannot rest without curving his spine out of shape, and the eye is brought too near; if too low he stoops over his work, compresses the veins of his neck, brings on cerebral congestion and becomes, in addition, round shouldered.

*Blackboards* should be of slate, or painted a dull black, so as not to reflect the light falling on them. Most of us have realized the misery of the child straining his eyes in the attempt to decipher, across the school-room, the not too plainly-written words or figures on greasy, shiny boards. Of course, they should never be placed between windows.

#### **Regular Medical Examinations of the School Children**

Are urgently needed and preferably made at the beginning of the school year. These investigations of the ocular and aural functions are easily made, so easily that the teachers can be readily instructed by the school physician how to carry them on. *The plan advised by Frank Allport is to be commended* as the best and most practical. It is fully outlined elsewhere in this work by that author himself.

Children with defective eyes should be sent to an oculist or ophthalmic dispensary and should not be allowed to re-enter school until they have received proper advice and treatment.

#### **School Books.**

These should be easily read and ought to be small enough to be readily handled. For ocular reasons they should not contain smaller type than "10 point" (long primer). The lines should be at least one-tenth of an inch apart, they should not contain more than 60 letters nor be more than  $4\frac{1}{2}$  inches long, so as not to fatigue the muscles in consequence of undue rotation of the eyeballs. *The paper* used in books and magazines should not be, as it often is, so highly glazed that it acts as a mirror to reflect the light into the eyes. It is not always possible to accomplish this where "half tone" illustrations



are frequently used with the text. In this book, for instance, a compromise has been effected by the *employment of a partially glazed, opaque paper*. The type should be distinct and the printing well done. Bad paper, poor ink, and worse printing are too frequently encountered in our books and newspapers.

The conjunctival vessels on the globe are in most cases enlarged, but, in the milder types, there is no marked redness of the ocular conjunctiva, the thickening and redness being confined to the conjunctiva of the lids, particularly at the junction of the lids and the eyeball in the retrotarsal folds.

Properly Spaced.

[The printed text of this book is also an example of proper spacing.]

#### **The Hygiene of Near Work in Adult Life.**

Here also is a consideration of prime importance. The enormous increase during the past twenty years in the amount and variety of work, which the full grown man and woman expect from the eyes, is largely responsible not only for the added need of glasses but for the great increase in the direct and reflex results of eye strain. If we expect to have comfort and to use our eyes to their fullest capacity we must select reading matter in large type, correctly spaced, printed with good ink in short columns, on unglazed paper. Other precautions are necessary, especially if the eyes are used constantly, as in the case of students, sewing girls, etc. The reader or writer should sit upright and a little forward; the book, paper or other form of near work (a heavy volume may be placed on an adjustable book-rest so that the top and bottom of the page are the same distance from the nose) must not be nearer than 12 inches nor more than 20 inches distant. The illumination should be from over the left shoulder or to the left and above the head. If it is impossible to have a proper arrangement of the light, the latter, if an electric or other form of lamp, should be covered so that sufficient light is thrown upon the work to be done, and an eye shade ought to be worn by the worker.

#### **Hygienic Value of Yellow.**

The use of yellow, amber or orange-tinted glasses by persons who desire to protect sensitive eyes against brilliant light is recommended

The conjunctival vessels on the globe are in most cases enlarged, but, in the milder types, there is no marked redness of the ocular conjunctiva, the thickening and redness being confined to the conjunctiva of the lids, particularly at the junction of the lids and the eyeball in the retrotarsal folds. Sometimes there is a slight chemosis present

Improperly Spaced.

by Motais, of Angiers. He has been using these yellow glasses for fifteen years.

These glasses, says the Paris *Cosmos*, give a remarkable illumination. The sky and objects are lighted up with warm tints, very agreeable to the eye. Besides, and despite this luminosity, they produce a quieting effect, so that with tints proportioned to the intensity of the light or to the retinal sensitiveness, the most sensitive eyes may be preserved.

They are the most agreeable, the intenser the light, and are consequently recommended to travelers in high latitudes or on the snow-fields of mountain regions, where they are exposed to the blinding rays of the sun.

They also modify, in summer, the brilliancy of the sands on a sea beach. In the mountains, on an automobile excursion, their illumination enables the traveler to regard the widest views without fatigue. Irritable eyes, even when they have normal visual power, will find it advantageous to substitute the agreeable impression of yellow glasses for the gloomy tint of blue or smoked glasses. This substitution is desirable when the visual acuteness of invalids is notably weakened, as in the many affections, such as retinitis, choroiditis, progressive myopia, atrophy of the optic nerves, keratitis, etc.

According to the investigations of Javal, continued by Tscherning and Sarazin, the double illuminating and quieting action of yellow glasses, apparently so contradictory, is explained by their suppression of the chemical rays of the solar spectrum. It may be remembered that about 1888 an English scientist who had devoted much time to ophthalmology strongly advised all persons who were earning their living with the pen never to use white paper when yellow could be obtained.

Apart from the evidently high-strung enthusiasm of this writer I am, from several years' experience of them, in favor of amber-tinted lenses rationally employed, rather than of the usual smoke-tint, blue or gray-colored lenses in common use.

#### **Injurious Reading Habits.**

It may be plainly stated that *reading while lying down (especially in bed when convalescent from an acute disease), in a railway train, on street cars, out-of-doors (by direct sunlight), by firelight, when tired or sleepy or when the eyes are fatigued or strained, is distinctly injurious.* Fine sewing, embroidery, china painting, drawing, engraving, working on black goods and similar tasks should be performed only in the daytime by persons possessed of the strongest eyes

and best health. Such work should also be interrupted with sufficient frequency. The *habit of wearing dotted or figured veils* is responsible for a good deal of eye strain. When they are used for protecting the face and keeping the hair smooth, or keeping the headgear in position, they should be thin, with a large, uniform mesh.

#### **Artificial House and Office Lighting.**

This is a matter that should follow the regulations applicable to common school rooms. The *illumination should be of proper amount and quality and should shine upon the work to be done and NOT directly or by reflection into the eyes of the observer*. For the general illumination of any room the best light is that which imitates diffused daylight—the sort of illumination most satisfactory to the whole visual apparatus. If these facts be borne in mind any form of artificial light may, with proper modifications to suit individual requirements, be employed. The problems involved in many office buildings, stores, banks, etc., are not easy of solution but we may, perhaps, arrive at the best light available by recollecting the following aphorisms:

(1) *Electric arc light should never be used for indoor illumination*; it is too brilliant, too dazzling and too *concentrated*; (2) owing to the heat evolved, the danger of fire, and the vitiation of the atmosphere by gas, *electric lamps are preferable*; (3) the Welsbach or Auer light, is too powerful for near work. If hung well out of range it is a good light for large rooms and show windows; (4) the *naked filament or wire light of the electric lamp gives an irregularly shadowed field of illumination* upon the printed page or other near work; it should, in consequence, always be covered by a ground or porcelain glass when employed close at hand; (5) diffusion of this light, as well as that from incandescent mantles with gas of all sorts, has lately been accomplished by *prismatic globes or holophanes*, so disposed that the light rays are mostly deflected downwards; (6) apart from the heat and vitiated air engendered by it, there is probably *no better reading light than the old fashioned argand burner* (or “students’ lamp”) with gas or kerosene. (7) An imitation of the students’ lamp has recently been accomplished by using with a 16 c. p. electric lamp a dull aluminum reflector. It acts very well, throws parallel rays on the printed page and does not shine into the reader’s eyes.

#### **Lighting by Means of Prism Batteries.**

Is of great value when, as in our crowded cities, the lower stories and rooms in buildings are rarely or never reached by direct daylight. These prisms are arranged as ornamental panes or as canopies in front

of the dark windows. For basements or cellars they are inserted in the pavement, with secondary screens below the sidewalk to assist reflection into rooms beneath.

# CHAPTER XXXII.

## ERRORS OF REFRACTION AND THEIR TREATMENT.

*The Emmetropic Eye—The Accommodation—Presbyopia—Abnormal Refraction or Ametropia—Hypermetropia—Eyestrain Symptoms from Hyperopia—Use of Cycloplegics—Comparative Value of Atropine, Homatropine and Hyoscine—Myopia—Astigmatism or Astigmia—Prescribing of Lenses—Skiascopy or Retinoscopy—Directions to Patients After the Prescription of Lenses.*

It is not possible, even if it were desirable, in this System, to describe the various methods of determining the refraction of the eye or of prescribing lenses for their errors and anomalies. In the monographs of Jackson, Thorington, Jennings, Landolt, Gibbons, Parker and others, not to speak of excellent chapters in most American textbooks devoted to this important department of ophthalmology, will be found a sufficient exposition of the measurement and conduct of ametropia. Here it must suffice to present only a bare outline of the management of ordinary cases.

### **The Emmetropic Eye.**

The normal or emmetropic eye is one in which, when the eye is in a state of rest, parallel rays of light coming from a distant point are focused on the retina. (*The emmetropic eye is 22 mm. (about an inch) in its antero-posterior diameter and this may be regarded as the standard or normal size-measurement and with which to compare other eyes that differ from it in shape and size).*

These rays, passing into the eye, have their course so altered by the structures which they encounter on their way to the back part of the eyeball—namely, the cornea, the anterior and posterior surfaces of the lens (called the refracting surfaces), the aqueous humor, the lens substance and the vitreous humor (called the refracting media)—that they become convergent and meet at the *fovea* in the retina, giving a clear image of the object looked at. This impression of the object is conveyed from the retina along the optic nerve to the visual centers, situated in the occipital lobe of the brain.

### **The Mechanism of the Eye.**

By means of the *accommodation* we are able to see near objects as distinctly as distant ones.

The degree of accommodation is different for every distance of the object. It is not suited for two different distances at the same time. If we look in the distance all objects nearer to the eye will appear blurred, and *vice versa*. In looking at distant objects with the normal eye no accommodation is required and the eye is said to be in a state of rest.

The *far point*, *punctum remotum*, of an eye is the distance at which objects are seen distinctly, while the *near point*, *punctum proximum*, is the nearest point at which an object can be brought to the eye and still be seen distinctly. The latter gradually gets farther away from the eye with age and the power to accommodate diminishes. This is due to *loss of elasticity in the fibers of the lens*, and light is less strongly refracted through it.

For reading and other close work, about twelve or fourteen inches is the distance at which we obtain most comfortable near vision; and, although the near point gradually recedes as age advances, no inconvenience is experienced *until about the fortieth year, when near work at that distance becomes slightly blurred* and there is an inclination to hold the print farther from the eye, in order to read distinctly.

#### **Presbyopia and the Use of a Lens.**

The condition described is known as *presbyopia*, or *old sight*, and in order that we may still do comfortable near work the loss of accommodative power must be replaced by a glass, in the form of a convex lens of sufficient strength, to give clear vision for the ordinary reading distance.

For every year past forty the near point still further recedes and stronger convex glasses are needed to enable one to read and do close work with comfort. At about the sixty-fifth year the power of accommodation is practically in abeyance.

The following table shows the decline of the power of accommodation from the tenth to the sixty-fifth year and the convex glass

#### **Accommodation (Jackson.)**

Age.	Near point, (inches).	Lens required.
10	2.81	
15	3.28	
20	3.94	
25	4.4	
30	4.9	
40	7.	
43	10.	0.50
50	16,	1.50

60	78.	2.75
65	00.	3.

[This table is based upon an average and cannot be taken as absolutely correct for all cases of emmetropia.]

necessary to take the place of the lost accommodative power and bring the near point to the most comfortable working distance.

#### **Abnormal Refraction or Ametropia.**

This condition is such that when the eye is in a state of rest, parallel rays of light come to a focus not on but at some point behind or in front of the retina and instead of presenting a clear image of the object looked at, vision is blurred and indistinct and the *eye has to exert its accommodative power to see clearly*, thereby causing fatigue and other symptoms of discomfort, setting up a condition known as *asthenopia*.

*Ametropia* is divided into 1. *Hypermetropia*, 2. *Myopia*, 3. *Astigmatism*, which Edward Jackson prefers to call *astignia*.

#### **Hypermetropia, Hyperopia or Far Sight.**

Here, when the eye is at rest, parallel rays of light from distant objects come to a focus at some point behind the retina, while divergent rays from near objects focus at a point still farther back of the retina.

In other words, *the hypermetropic eye is an eye that is smaller than it ought to be*—an undeveloped eye.

We have seen that in an emmetropic eye no accommodative effort is required to see *distant* objects distinctly and the accommodation is but slightly called upon when we wish to do near work. In far sight such is not the case, as the course of the rays of light entering the eye must be so altered by an increased effort of accommodation before they focus exactly on the retina and give distinct vision for distant as well as for near objects. A greater effort is required for the latter than for the former. *The accommodation being constantly called upon the ciliary muscle is in a continual state of contraction and becomes hypertrophied*. Such a condition of affairs leads to symptoms of discomfort not only in the eye, but in the structures surrounding it.

A slight amount of farsightedness may not cause any unpleasant symptoms, especially in youth when the general health is good and the eyes are not used for much near work. Children at birth are usually hypermetropic; this condition generally becomes less marked and may, as it often does, pass into a state of normal refraction.

#### **Some Results of Eyestrain.**

The persistent and excessive demand made upon the accommodation for the purpose of giving clear and distinct vision frequently *pro-*



duces a sort of *cramp of the ciliary muscle*, causing pain and congestion in and around the eyes and inability to use them for any length of time for near work.

This is especially true of a farsighted eye, because a part of the accommodative power having already been used up in obtaining clear vision when looking in the distance, there is much less to fall back upon, and a *greater effort is required to see clearly when the eyes are called upon to do prolonged reading, sewing, book-keeping, etc.* The vision soon becomes blurred and the eyes have to be rested before the work can be continued.

If much near work is persisted in complaint is made of *pain, fatigue, a sensation of weight, frontal headache and other symptoms of discomfort about the eyes*, a complex of symptoms commonly called *eyestrain* (q. v.). The conjunctiva becomes congested and frequently the margins of the lids are red and inflamed. Soon there is a feeling of sand in the eyes, with burning and smarting of the lids and eyeballs and an increased secretion of tears. (See *Hyperemia of the conjunctiva*.)

Where *the strain is kept up for some time styes and other affections of the lids are frequently met with*. When this strain is not relieved by appropriate treatment the effort even to see distant objects distinctly also causes marked discomfort until eventually the patient is no longer able to use his eyes for any purpose, even for a few moments, with comfort. This condition is known as *Accommodative Asthenopia*.

A *farsighted eye*, as has just been noted, is a small eye and this abnormal state is due in the majority of instances to shortening of the antero-posterior diameter of the eyeball, to which is given the name *Axial Hypermetropia*. Less frequently it depends upon some deficiency in the curvature of the cornea or lens. (*Curvature Hypermetropia*) or upon the absence of the lens (*Aphakia*). It is almost invariably a congenital and rarely an acquired condition.

#### **The Correction of Farsightedness.**

For the correction of farsightedness it is necessary that parallel rays of light should be brought to a focus on the retina without the aid of the accommodation. This is *accomplished by means of a convex lens in front of the eye*, of sufficient strength to make the rays, as they enter the eye, more convergent. The greater the amount of hypermetropia the stronger the convex lens must be.

*When there is spasm of the ciliary muscle* (and this condition is more or less present in a large percentage of the cases) a variable amount of the error is *masked* and in some cases the cramp of the

muscle is so great that the eye presents a condition of *false myopia*, due to the effort of accommodation being so great (in the endeavor to focus the rays on the retina) that it is overdone and the rays apparently focus in front of the retina.

In determining the true or total amount of farsightedness, as well as of the *other forms of ametropia*, the power of accommodation should be relaxed and the ciliary muscle paralyzed by the use of one of the many cycloplegics (q. v.) at our disposal, e. g. ;

℞	
Atropin. sulph.	gr. iv
Aq. dest.	f ʒi

One drop into each eye three times daily for two days ; or

℞	
Homatropin. hydrobrom.	
Cocain, hydrochlorat. āā	gr. iv
Aq. dest.	f ʒss

One drop into each eye every 10 minutes for one hour. In suitable cases full, but transient, cycloplegia occurs in an hour and a half after the first drop.

Better still is the use, every twenty minutes for an hour, of a *gelatine disc* (q. v.) containing, each, 1-30 grain of *homatropine and cocaine alkaloids*. (See the section on *Cycloplegics*.)

F. A. Morrison (p. c.) prefers the following mixture, instead of a solution or the *gelatine discs*, for the purpose of insuring prolonged contact of the cycloplegic with the eye-ball.

℞	
Cocain. hydrochlor.	
Homatropin. hydrobrom. āā	gr. iss
Pulv. acaciæ	ʒii

A little to be placed on the eye-ball, or in the sac, near the outer canthus. Keep the eye closed.

F. B. Eaton (p. c.) prefers *hyoscin gelatine disks*, 1-1000 to 1-500 gr. each, to atropin or any other cycloplegic.

After considerable experience with *gelatine hyoscin discs* (gr. 1-2000) I find if a single disc put into the sac five minutes after the instillation of a single drop of a 2 per cent. solution of cocaine hydrochloride and homatropine hydrochloride that one gets the maximum cycloplegia with the minimum expenditure of time, provided the patient can afford to have ciliary rest for seventy-two hours. An important consideration in this procedure is that the cocaine benumbs

the conjunctiva and cornea and one does not experience the foreign body sensations and other discomforts arising from the introduction of discs into the conjunctival sac.

D. M. Griffith (p. c.) finds that the *most marked cycloplegic* effects can be obtained from *small doses of atropine combined with dionin*. He also believes that the addition of dionin inhibits the toxic effects of the atropine. He generally uses this formula:

R	
Atropiæ sulph.	gr. i,
Dionin.	gr. v,
Aquæ dest.	fl. ʒii.

Two drops in each eye three times a day for four days.

Alexander Randall (p. c.) *prefers hyoscyamine* (2 grains to the fluid ounce) as a cycloplegic. He has found it prompt and vigorous, holding the ciliary muscle firmly in its grasp for 72 hours, meantime giving complete, enforced rest. The cycloplegic effects practically disappear in 150 hours after the initial instillation.

Other ophthalmologists prefer:

R	
Hyoscin. hydrobrom.	gr. i
Aquæ dest.	f. ʒi

One drop into each eye three times daily for two days.

Wendel Reber (*Jour. Amer. Med. Assn.*, April 25, 1908), uses homatropin semi-occasionally, and atropin infrequently. During the last six years he has seen upwards of 2,000 cases of refraction error in private practice, and has used a 1/10 *per cent. solution of hyoscin hydrobromate, containing also 1/5 per cent. cocaine*. In about one case in fifty there is rather marked flushing of the face, quickening of the pulse and some slight vertigo, but not more than is sometimes seen with homatropin. Not once was pronounced "toxemia" noticed. Compression of the canaliculi immediately after instillation will prevent even the slightest constitutional reaction. The solution is instilled once or twice the evening before, and twice the morning of the examination. For office use cocaine solution, 2 per cent., warmed, which is instilled, and the hyoscin dropped in, also warm, twice at intervals of a half hour. An hour later the testing may begin. Accommodation is sufficiently re-established for ordinary purposes at the end of 48 to 60 hours. It is not wise to attempt to hasten this by instilling eserine, as the benefit of the rest under a mydriatic is thus forfeited. The ideal would be to completely paralyze accommodation

and put the internal ocular structures at perfect rest by atropin prior to testing the refraction, but this is often impracticable.

Alexander Duane\* believes that a cycloplegic should be employed for determining the refraction in practically all cases, not glaucomatous, below 48 years of age and in some cases above this limit.

Homatropine in 2 per cent. solution, provided it is used with ordinary precaution, is a safe cycloplegic, and if properly used is effective in the vast majority of cases.

It should be repeatedly instilled and the examination made not less than an hour after the first instillation nor until a test of the accommodation has shown that the latter is as completely abolished as possible.

The cases in which homatropin proves inefficient are few. They are marked by varying vision and varying acceptances, discrepancies between the subjective tests and the skiascopic findings, and the persistence of an undue amount of accommodation (more than one D) even after prolonged action and repeated instillations.

In such cases atropin should be used.

Macklin (25) prefers *atroscline* to other cycloplegics for determining refractive errors, and uses it as a *one per cent. solution in castor oil*. He says it acts as a rapid and powerful mydriatic and cycloplegic, is as potent and reliable as atropine sulphate, while the power of accommodation returns in five days. Of course, with homatropine the ciliary paresis ceases in 24 hours, which is undoubtedly a great advantage in many cases, yet homatropine has disadvantages which must be apparent to all who use it. Mydriasis with *atroscline* begins in ten minutes and is complete in twenty. Cycloplegia begins in ten minutes and is complete in about fifty.

Rest of the eyes from all near work is imperative in many cases.

#### **Myopia, or Short Sight.**

We have here a condition that *implies* a larger eye than normal (one that has slowly increased in size, usually as the result of strain) in which parallel rays of light from a distant object come to a focus in front of the retina and then diverge to form a blurred image of the object.

*Shortsight of moderate degree, unassociated with astigmatism, causes very few symptoms.* The main complaint is the inability to see distant objects distinctly, but ordinary near work is performed with even less discomfort than in the farsighted eye. A refractive condition of this sort is suited for near work (about twelve to four-

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\*N. Y. State Journal, July, 1908.

teen inches from the eye) because the muscle of accommodation is required to make no undue effort to see objects distinctly at that distance.

We have seen that *in a farsighted eye a very active accommodative power is necessary for the purpose of seeing both distant and near objects distinctly. In short sight such is not the case*, for if the accommodation were active the rays of light would come to a focus at a point still farther in front of the retina and a more blurred image of the object would be produced. Therefore, in this error of refraction we have a poorly developed ciliary muscle, because the rays of light coming from an object situated at the near point will focus without the aid of accommodative power and give a clear and distinct image.

Moreover, the higher the amount of myopia the nearer to the eye will near point be and the nearer to the eye will the patient have to hold the reading, sewing, etc. Hence, so long as the near point corresponds to the ordinary reading distance, *the shortsighted patient is able to perform the near work required of him without any marked symptoms*, and it is only when this point approaches too near the eye that discomfort is complained of.

Those who have myopic eyes are usually fond of reading, sewing, music, etc.; they rarely take an interest in outdoor sports, chiefly because they are not able to see distant objects distinctly. To obtain a clear view of distant objects *myopes frequently "squeeze up their eyes," i. e., pinch their lids together until these form a slit-like aperture* and so cut off the confusing light rays, that otherwise enter the peripheral portions of the crystalline lens, and allow only the more direct ones to pass through its center. These latter make fewer *diffusion circles* when they reach the retina and so render the image clearer.

*Myopia* is in the majority of instances due to the antero-posterior diameter of the eyeball being too long (*axial myopia*). Less frequently it is caused by an increase in the curvature of the cornea or lens. It is frequently met with in old people who have beginning cataract, which often causes swelling of the lens. This is known among the laity as "second sight," because the patient has improved vision for reading and may even be able to read without spectacles, although at the same time he sees worse in the distance.

*Shortsight is almost always an acquired condition*, due in the majority of instances to excessive demands made upon the eye for near work in early childhood. It develops about the eighth year and either remains at a standstill or gradually increases in amount, con-

stituting *progressive myopia*. The latter stage is largely determined by continued use of the eyes for near work, especially with poor illumination.

Heredity acts as a predisposing cause, the children of myopic parents being more prone to myopia than those whose parents are hypermetropic. It is especially to be looked for in weak, sickly children, for whom outdoor games have few charms, and who are allowed to abuse their eyes with much reading, sewing, embroidery, music, etc.

### **The Progress of Shortsight**

Depends upon a still further elongation of the globe in its antero-posterior diameter owing to stretching of the tunics of the eyeball at their widest point—the posterior pole. This is mostly due to the pressure exerted by the lateral muscles in their endeavor to make the eyes converge for the abnormally near working point.

As the disease progresses *all the tissues of the eye-coats are put upon the stretch* and changes of a pathologic character take place within the eyeball. The vessels of the globe become congested, opacities form in the vitreous humor as the result of inflammation of the choroid, vision becomes considerably impaired and at last blindness may set in, owing to further implication of the parts necessary to the visual act.

### **The Treatment of Myopia**

Consists in the *prescribing of proper concave glasses for distance and near work*, in order to bring the eye as near as possible to the normal condition of refraction. All close work should be restricted and the eye not allowed to become fatigued. The general health of the patient should be looked after.

*No reading, sewing, or other near work, should be done except under good illumination*, and print should be held at the proper distance from the eyes.

*The light used for near work should never be allowed to fall directly or indirectly upon the face*, and to this end it should be placed behind, or above the head, and a little to the left, where it will fall upon the work to be done.

*Print should not be too small* and the patient must not be allowed to bend the head over his work, thus avoiding congestions of the vessels in the interior of the globe. If there is a tendency in the disease to progress *all use of the eyes must be forbidden* and, if in a child, he should be taken from school and obliged to lead an outdoor life. (See the chapter on Ocular Hygiene for a more complete statement of the rules of ophthalmic sanitation).



**Astigmatism.**

Or *astigmatia*, is that condition in which there is an *unequal curvature of the cornea or lens*, but especially of the cornea, causing rays of light passing into the eye to come to a focus at two different points. It is divided into *regular* and *irregular*.

**Irregular Astigmatism.**

In this condition the rays have different foci in the same meridian. This is usually caused by irregularities of the corneal surface or changes in the lens substance. Corneal ulcers, leaving scars and facets on healing, is the common source of irregular astigmatism. Vision is much impaired and can be very little improved by glasses.

**Regular Astigmatism.**

Here we have one *principal meridian* of the cornea with a greater curve than the other. These two principal meridians are always at right angles to one another, the meridian of greater curvature being usually situated in the vertical and that of less curvature in the horizontal meridian. When this is the case the astigmatism is said to be "with the rule;" when the reverse the astigmatism is said to be "against the rule." Regular astigmatism comprises:

1. The *simple form*, in which one meridian is ametropic while that at right angles to it is emmetropic. When the rays focus behind the retina it is *simple hypermetropic*, and when in front of the retina *simple myopic astigmatism*.

2. The *compound form*, in which neither set of rays of light entering the eye focuses upon the retina, but does so either in front of or behind the retina, according as it is a *compound hypermetropic* or a *compound myopic astigmatism*. In either form the rays have a different focusing point for the two principal meridians.

3. The *mixed form*, in which one set of rays of light entering the eye focuses at a point behind the retina (*hypermetropic meridian*) while those entering through the meridian at right angles focus at a point in front of the retina (*myopic meridian*).

Inasmuch as the majority of the forms of astigmatism are due to the *abnormal shape of the eyeball* it is usually congenital, but in some instances (after operation, injury, etc.) it may be acquired.

*Astigmatia generally produces discomfort* when the patient attempts to use the eyes for reading, sewing, or other forms of near work. All the symptoms met with in *eye-strain* (q. v.) due to hypermetropia or myopia are more or less aggravated by the addition of astigmatism even of low degree, especially if the patient be in a poor state of health and of a neurasthenic disposition. Distant as well



as near vision may also be materially interfered with and decidedly uncomfortable.

Astigmatism should be corrected with a cylindrical glass either alone (in simple astigmatism) or in combination with a spherical lens in compound or mixed astigmatism. The axis of the cylinder is placed in the meridian of greater corneal curvature in hypermetropic astigmatism, *i. e.*, the meridian of normal refraction in simple astigmatism, and the meridian of least ametropia in compound astigmatism. *Even low degrees of astigmatism should be corrected in the majority of instances* and glasses in the form of *spectacles* should be worn constantly.

### Prescribing of Lenses.

A successful outcome in determining *the amount of myopia, hypermetropia, or astigmatism in the eye or eyes of a patient*, depends largely upon the ability to use properly at least *two methods of measurement*. It is by no means the simple process the optician or the jeweler would have us believe.

Assuming that there is no organic disease of the eye, particularly no opacities in the dioptric media—the cornea, lens and vitreous—the refraction should be first measured objectively, that is, with some instrument like the ophthalmoscope, or, better still, with the skiascope.

Having reached a conclusion, a “control” test should be made with test lenses, that is, with such convex and cylindric lenses (and combinations of these) as are found in the “test case,” that enable the patient to see best in the distance.

The difficulties that present themselves, when an asthenopic patient is to be “fitted with glasses,” are many. That one may solve these problems with most benefit to the patient, not only must the total refractive error be estimated for each eye separately by the foregoing methods, but *the condition of the media and fundi, the state of the general health, the balance of the extrinsic eye muscles, the condition of the accommodation, as well as the amount and kind of eye work, must be taken into consideration.*

In the same way the surgeon must decide whether a partial or full correction shall be worn, whether for the distance, for near work, or for both distance and near, or whether two different pairs of glasses (for distance and near) will be required. Will it be wise to keep the ciliary muscle paretic for a time, so that the accommodation is in abeyance while the patient gets accustomed to the new refractive condition induced by the spectacles? Can the patient finally dispense with the lenses ordered, or can he, after wearing them for a time constantly, eventually use them only for reading, writing, etc.?

THE IMPROVEMENT OF DEFECTIVE VISION is, in this country at least, less frequently our object in ordering glasses, than the relief of certain symptoms that have no particular relation to the eyesight. As a matter of fact, we know that most people wear lenses not to enable them to see objects about them more clearly, but to use their eyes without discomfort of some kind.

It is for the relief of *eyestrain* chiefly that we order glasses and this condition is found more commonly in *hyperopia* and *astigmatism* (astigmia) than in *myopia*. Although the myope cannot, for example, distinguish a friend across the street without his glasses and is obliged to hold his book close to him when he reads he rarely suffers from eyestrain.

### Symptoms of Ametropia.

Among the numerous symptoms set up by ametropic eyes in their attempts to see normally are headaches, pains in the eyes, fatigue of the eyes, frontal "neuralgia," vertigo, insomnia, "nervousness," dyspepsia, *muscae volitantes*, car sickness, nausea and melancholia.

Referred directly to the eyes or eyelids are burning, smarting, "drawing" and foreign-body sensations, lachrymation and "hot eye," not to mention actual organic alterations in the ocular tissues (ametropic choroiditis, cataract, granular lids, conjunctival hyperemia, styes and blepharitis) due to the chronic vascular changes set up by long continued efforts on the part of the muscular apparatus to bring about normal vision.

Occasionally this constant irritation of the central system is responsible for attacks of chorea, epilepsy, migraine, neurasthenia, "nervous" indigestion, "biliousness," and other disorders of the sympathetic system—symptoms that disappear when proper glasses are worn.

### The Ophthalmometer.

Corneal astigmatism is measured by an instrument called the *ophthalmometer*, whose efficacy depends upon the variation in the images of objects in the apparatus (*mires*) cast upon the abnormally shaped cornea. The various positions assumed by these images (as seen through a telescope) are registered and the amount of astigmatism calculated.

### Skiascopy, Retinoscopy or the Shadow Test.

A ready means of determining not only the kind of refractive error but the amount of it is *retinoscopy*, *skiascopy* or the *shadow test*. Its ordinary use does not call for any considerable knowledge of physiologic optics nor does it need much practice.

By means of this *objective method* the result is obtained independ-

ently of the observations of the patient under examination. The light from a gas-jet or electric lamp falls upon a concave or plane mirror and is reflected into the eyeballs through the pupil. The retinal movements and shadows are observed as the mirror is rotated in various directions.

This method is especially useful where it is not desirable to depend upon the statements or observations of the patient. It is particularly valuable in dealing with children, illiterates, amblyopes, and others where an accurate subjective estimation of the full amount of the ametropia is, for obvious reasons, difficult or impossible. It is, on the whole, the most satisfactory objective test we possess. Where it is possible, the skiascopic result should afterwards be verified by test lenses.

*In employing this test the examiner should be seated in a darkened room one meter, or about three feet, in front of and facing the patient, whose accommodation, if he be under fifty years of age, should be paralyzed by means of a cycloplegic (q. v.)—atropine solution, or homatropine and cocaine.*

The light should be placed above and behind the patient's head, if a concave mirror is used; or it should be within five or six inches of the observer's eye, if the plane mirror. The source of light should be covered with a Thorington light screen, or asbestos chimney, and provided with an iris diaphragm to regulate the amount of light falling center of the mirror.

The mirror with which the light is reflected into the eye has a small opening in its center (through which the observer looks), the edge of the mirror resting against the edge of the brow. The light is thrown from the mirror into the eye so that the red reflex of the fundus is seen by the observer as he looks through the hole in the center of the mirror.

As the mirror is rotated in the principal meridians of the eyeball, a shadow will be observed within the area of the red reflex, moving in a direction contrary to or with the movement of the mirror, as the patient is hypermetropic or myopic. The shadow direction will also depend upon the sort of mirror used, whether it be concave or plane.

With a *concave mirror* the shadow moves *against* the movement of the mirror in emmetropia, in myopia of less than one diopter and in hypermetropia. It moves *with* the movement of the mirror in myopia of more than one diopter. With a *plane mirror* the shadow moves *against* the movement of the mirror in myopia of more than

one diopter and *with* it in emmetropia, myopia of less than one diopter and in hypermetropia.

As soon as the direction of the shadow has been determined, convex glasses, if the patient is emmetropic, myopic less than one diopter or hypermetropic, and concave glasses if the patient is myopic more than one diopter, should be placed in the spectacle frame in front of the patient's eye and increased in strength *until that glass is reached which reverses the movement of the shadow*.

The two principal meridians of the eyeball, usually the vertical and horizontal, should in this way be worked out separately. If the same lens reverses the shadow in each meridian we have simple hypermetropia or myopia, as the case may be. If it is a hypermetropia, say of three diopters, it is recorded as follows:

$$\begin{array}{c} +3 \\ | \\ \hline | \\ +3 \end{array}$$

Skiascopy Results in Simple Hypermetropia.

If myopia, as follows:

$$\begin{array}{c} -3 \\ | \\ \hline | \\ -3 \end{array}$$

Skiascopy Results in Simple Myopia.

As the observer is one meter from the eye under examination—the distance of the point of reversal of a myopic eye of one diopter—that amount should be subtracted from the result in hypermetropia and added to the result in myopia. In other words, in the skiascopic result, the hypermetropic eye is over-corrected and the myopic eye under-corrected one diopter in each meridian. The results should then read, to give the real state of things:

$$\begin{array}{c} +3 \\ | \\ \hline | \\ +3 \end{array} \quad \begin{array}{c} +3 \\ -1 \\ \hline +2 \end{array}$$

$$\begin{array}{c} -3 \\ | \\ \hline | \\ -3 \end{array} \quad \begin{array}{c} -3 \\ -1 \\ \hline -4 \end{array}$$

In the first instance the patient is farsighted to the extent of two

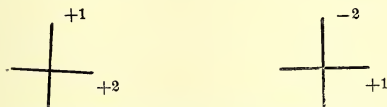
diopters; in the later myopic four diopters. If a spherical convex lens of  $+2$  diopters, or a spherical concave of  $-4$  diopters were placed in the trial frame before the eye, the full amount of the hypermetropia or myopia would be corrected and the correction would, in each case, make the patient emmetropic and give him the best vision.

We have seen that in regular astigmatism the refraction in the two principal meridians is unequal. When, therefore, the point of reversal is found in one meridian, that at right angles to it is still uncorrected. The lenses should now be adjusted so that the shadow in this other meridian is reversed. The difference between the two meridians gives the amount of the astigmatism.

In the retinoscopic result the meridian of least error corresponds to the axis of the cylinder employed to correct it, and this, in the majority of hypermetropes, is in the vertical meridian, usually indicated by  $90^\circ$ ; while in myopia it is in the horizontal meridian (or at  $180^\circ$ ).

#### In Simple Astigmatism

(Astigmia) the reversal of the shadows might be represented as follows:



Skiascopy Results in Simple Hypermetropic and Simple Myopic Astigmatism.

Adding—1 (the point of reversal of a myopic eye of one diopter at one meter) to each meridian the formula to be placed in the trial lens in front of the eye would read:

$$\begin{aligned} +1\text{D cyl. ax. } 90^\circ \\ -3\text{D cyl. ax. } 180^\circ \end{aligned}$$

#### In Compound Astigmatism

The reversal of the shadows would be as follows:



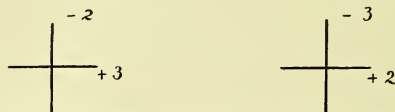
Skiascopic Results in Compound Hypermetropic and Compound Myopic Astigmatism.

Adding—1 (the point of reversal of a myopic eye of one diopter at one meter) to each meridian the formula to be placed in the trial frame in front of the eye would read:

$$\begin{array}{l}
 +1\text{D sp.} +1\text{D cyl ax. } 90^\circ \\
 -3\text{D sp.} -1\text{D cyl ax, } 180^\circ
 \end{array}$$

### In Mixed Astigmatism

One meridian is myopic (usually the vertical) and that at right angles to it is hypermetropic (usually the horizontal) as concave lens, say of 2 D being used to get the reversal of the shadow in the former while a convex lens, say of a 3 D is used for a like purpose in the latter meridian. The skiascopic result would read as follows:



Skiascopic Results and Correction in Mixed Astigmatism.

Adding—1D (the point of reversal of a myopic eye of one diopter at one meter) each meridian, the result should then read to give the real state of things:

The lenses to be placed in the trial frame before the eye may be either one of the following:

1. Using crossed cylinders, as follows:  
 $-3$  cyl. ax.  $180^\circ$   
 $+2$  cyl. ax.  $90^\circ$
2. Using a convex sphere and a concave cylinder:  
 $+2\text{D sp.} -5\text{D cyl. ax. } 180^\circ$
3. Using a concave sphere and a convex cylinder:  
 $-3\text{D sp.} +5\text{D cyl. ax. } 90^\circ$

In mixed astigmatism the sum of the two results gives the amount of the astigmatism, because a convex or concave spherical lens placed in front of the myopic or hypermetropic meridian produces just as much more myopia or hypermetropia, as the case may be, in that meridian, and requires the addition of a concave or convex cylinder of such strength to correct it.

### Anomalies of the Accommodative Apparatus.

We are prone to forget that the main object of correcting ametropia is to enable the focusing apparatus to do its work easily—without strain—and, that accomplished, in the majority of instances the “asthenopia” or “asthenopic symptoms” disappear. This is not, unfortunately, always the case. To determine just how such errors of focus are mended is to be learned in some of the deep mysteries of the science and art of refraction. The following hints from a well-known writer may assist the student:

Speaking of the *treatment of actual excessive accommodation*,

Lucien Howe (*Muscles of the Eye*, II, 1908) recommends as the "*sine qua non* of therapy—rest, "rest from any occupation which acts as an exciting cause, rest of the ciliary muscle such as is possible by means of convex glasses, and above all, rest by means of a strong cycloplegic continued during a considerable time. Occasionally when this form of imbalance occurs alone and frequently when it occurs as a component part of compound imbalance, the so-called 'blurring' plan of treatment is of decided advantage. This means nothing more than constant over-correction with convex glasses and therefore more and more enforced rest of the ciliary muscles."

"The *general treatment* of each case by itself is necessary, as systemic conditions vary greatly. We may have the anemic type, in which the spasm of accommodation is dependent upon insufficient assimilation of nutrition. In these, tonics and out-of-door life are of course the first consideration. Or we may have quite a different type, in which there is apparent plethora due to sedentary habits and overfeeding. Alcohol or nicotine may be contributing factors, even though the amount of either consumed may not be actually great. In a word, the general treatment is indicated by the condition presented, and the ultimate result depends largely upon the patience and persistence with which these different causes are diagnosed, and one after the other eliminated from the problem."

*Treatment of Actual Insufficient Accommodation.*

Howe (*"Muscles of the Eye*, Vol. II) says that *treatment* "is often unsatisfactory, although much of course depends on the cause in each individual case. Locally there is not much to be done. Occasionally the persistent use of eserine has been tried, but when any lessening of the symptoms did occur, it was doubtful if that was not dependent as much upon the improvement of the general condition of the individual as upon the drug. As diphtheria is in a certain number of cases either a remote or an immediate cause, it was suggested long ago that the serum therapy might prove of advantage. Its use for that purpose has been advocated by some of the most careful observers, while others have obtained only disappointing results. The general opinion seems to be that in recent cases the serum therapy is of undoubted advantage, but of little or no use in those of long standing. In the latter, nature's own method of treatment seems to be as good as any, although some practitioners may insist upon the virtues of cabinet baths, certain cathartics, or similar treatment. As for other medication, the use of iron is always indicated, but the blood should be tested occasionally to make certain that the form in which it is administered is such as to permit its being taken into



the system. Above all, reliance can be placed upon out-door life, such as actual work on a farm, or some form of gymnastics. Most persons object to giving up their occupation for life on a farm, and many others are not so situated that they can indulge in golf or similar amusements. What, then, are we to do with those who cannot afford costly forms of exercise? What can we do with the anemic clerks and seamstresses who crowd the clinics, bringing the same story of headaches which glasses fail to relieve? For them dumb-bells and Indian clubs are undoubtedly of advantage and are inexpensive. The bicycle has furnished an excellent method of treatment, and has probably cured many a case of insufficiency." (See Appendix A).

#### **Directions to Patients After the Prescription of Lenses.**

I am in the habit of asking the optician to co-operate with me in rendering the work of determining the refractive condition of the patient and the ordering of proper glasses as effective as possible. With that end in view each patient is furnished with a slip upon which is printed the following:

"It is sometimes difficult for the doctor to decide whether the glasses ordered for the patient are satisfactory and are producing the results desired by him, until they have been worn for a time. It is in consequence particularly requested that for his own benefit *the patient return to the oculist after he has used his lenses for ten days (or for the period prescribed)* so that this important matter may be decided."

The optician furnishes the following:

"In order to derive the full benefit from the use of glasses, at least two things must be constantly borne in mind. First: the lenses must be kept absolutely clean and transparent, free from dust and oily accumulations derived from the fingers, eyelashes and from perspiration. To accomplish this, wipe the glasses as often as may be necessary with clean tissue paper, cotton (not linen or silk) or chamois skin. If this be done every morning, the lenses will, if properly adjusted, usually remain transparent most of the day. The lenses and frames should be washed with warm soap and water once a week. Any foreign substance on the surface of the glass compels the eye to strain in its attempt to secure a clear picture, and thus becomes a source of discomfort and injury to the eye. Do not take hold of or touch the lenses with the fingers; handle them by the frame or the edges of the lenses. Second: it is still more important to make sure that the frames do not become bent or loose, thus allowing the lenses to get out of their proper position before the eyes. It is very important *when the patient has astigmatism or high degrees of far and near sightedness*, since the

optical effect of the glasses is entirely changed if the glasses are allowed to become in the least degree displaced from the original position.

This is the reason, also, why nose-glasses are generally harmful, especially when the lenses are to be worn constantly. The effect of cylindrical glasses prescribed for astigmatism depends upon their being always rigidly maintained in the same position in front of the eye—a condition difficult or impossible to accomplish or maintain when nose-glasses are worn. For this reason, too, it is better to have stiff (and carefully adjusted) wire bows than the so-called “twisted cable” temple pieces which, though non-irritating, do not keep the lenses in their proper place before the eyes. Eye glasses when ordered by the oculist should be carefully adjusted by the optician and readjusted as often as required.

Spectacles that have the bows extending behind the ears should never be put into a case when not in use. Lay them down open on a table or in a drawer, not resting on the lens surfaces, but just as they are taken off, on their edges. This prevents scratching of the glass and keeps the bows from being bent out of shape. When the frames, from accident or long-continued use, get out of shape, bring them at once to me for readjustment. Gold frames are usually the best because they keep their shape, are readily repaired, do not rust and break, and are not so likely to irritate the nose and ears. If the lenses are to be worn for some time, gold frames are cheapest in the end.

*Frameless Lenses* are less conspicuous and do not weigh as much as those with frames, but it must be remembered that the former are more easily broken and require more care than the latter.

*Bifocals* are double lenses designed to obviate the necessity of carrying two pairs of glasses—one for seeing in the distance and the other for reading and writing. People who need these two kinds of glasses find bifocals very convenient. But only about one-half of those who attempt to wear them succeed in doing so comfortably. The reading portion of the lenses interferes with distant vision toward the floor or the steps in climbing stairs and the head must be inclined sufficiently forward to enable the upper or distance portion of the lens to be used. Then, again, the change in looking about from the distance to the reading portion of the lens or vice versa is often confusing and requires much patience and perseverance to overcome. For these and other reasons not everybody is able to wear this otherwise useful combination.

The so-called “invisible” bifocals possess quite a few advantages. For example, the lower glass in this style, cannot be seen

and the outer and inner surfaces of the lenses being smooth are more easily kept clean than the ordinary bifocals. On the other hand they are much more expensive than and are not superior, from the optical standpoint, to the common bifocal lenses. *Bifocal glasses require regular adjustment as much as nose glasses do.*"

#### Adjunct Treatment of Ametropia.

Chloretone is often combined with cocain and other alkaloids, generally in the proportion of 2 per cent. It is a favorite remedy of my own for the relief of the *burning and smarting* that so often accompany the *lid hyperemias of eye-strain*.

R

Chloreton.	0.10 grm. (gr. 7/10)
Sodii boratis	0.50 grm. (gr. 7½)
Aquæ dest.	30.0 c.c. (f℥j).

Theobald (*Text-book*, p. 515) prefers the *oleate of veratrine* in 10 per cent. strength to any other preparation of the kind in *asthenopia* and *frontal headache due to accommodative strain*. He also employs it to lessen the irritability of the ciliary muscle preparatory to testing errors of refraction. A little is to be rubbed upon the forehead and temples once a day, preferably in the morning. None of it should be allowed to enter the eye, as it causes severe and persistent irritation.

For the *hyperemia of the conjunctiva* and the *irritative symptoms* that accompany refractive errors and that occasionally persist after they have been properly corrected Hanford McKee (p. c.) prescribes a collyrium containing *one-sixteenth of a grain of zinc sulphate to the ounce of water*. To the same end he often uses iodoform powder on a homatropin and cocain disc, or a little ointment of iodoform—ten per cent. strength.

As a *ciliary tonic in asthenopic cases* C. R. Gardner (p. c.) advises the following collyrium, a few drops to be put into the eye three times daily:

R

Eserin. sulph.	gr 1/48
Holocain. (1 per cent. sol.)	gtt. xx
Acidi borici	gr. vi
Aquæ rosæ	fl. ℥ss

For *painful eyes in neurasthenic patients*, where the irritation continues after the correction of the refractive error W. O. Moore (p. c.) advises the instillation of a few drops three times a day of a 1 per cent. solution of *antipyrine*.

For further consideration of the treatment of the consequences of *eyestrain*, see the chapter on that subject, as well as that dealing with the treatment of *hyperemia of the conjunctiva*.

# CHAPTER XXXIII.

## NON-OPERATIVE TREATMENT OF ANOMALIES OF THE ORBITAL MUSCLES. SQUINT.

*Anatomy and Physiology—Heterophoria and Its Meaning—Hyperphoria—Hypophoria—Anophoria—Katophoria—Cyclophoria—Treatment of Heterotropia—Squint or Strabismus—Heterotropia—Convergent and Other Forms of Squint—Treatment of Squint—Paresis and Paralysis of the Ocular Muscles—Tabes and Diphtheria—Nystagmus and its Treatment—Myositis Orbitalis.*

This work does not contemplate an exhaustive study of rare and obscure oculomuscular anomalies although it does propose to deal with the conduct of those errors of muscular balance that the ophthalmologist mostly encounters. For a complete study of the surgical and other treatment of these anomalies, both extraocular and intraocular, the reader is referred also to the admirable treatises of Savage, Howe, Hansell and Reber, Worth, Maddox and Landolt.

For a correct understanding of the principles that should govern the treatment of muscular anomalies, especially of the various *heterotropias, heterophorias, pareses and paralyses*, it is essential that the student be familiar with all the relations of these defects; as in the case of treatment of ametropia it is impossible in this System to do more than indicate a few of the methods that will be found useful in certain cases. The successful treatment of examples of oculomuscular imbalance not reached by *correcting a concurrent refractive error*, by general treatment, by prism or other gymnastic exercise, by the wearing of prismatic lenses, by change of occupation, or by the adoption of other hygiene, is recourse to operative procedure.

The student is, therefore, strongly advised to read in this connection the masterly works of G. C. Savage ("*Ophthalmic Myology*" and the companion work, "*Ophthalmic Neuro-Myology*"), Lucien Howe ("*Muscles of the Eye*")—especially the latter work—for a complete exposition of the subject. There are, in addition, practical monographs on this topic by other American writers—Hansell and Reber, Jackson, Duane, Stevens and others that give precise information regarding this important subject. I have myself endeavored to present for the student the rudiments of the subject in the Posey-Wright *Text-book of Diseases of the Eye*.

### Anatomy.

The center about which the eyeball rotates is situated in the line of its visual axis, about 14 mm. behind the cornea. Six muscles turn (not draw) it in every possible direction, as well as give it a sort of *wheel motion* on its axis. If it were possible for them to operate separately we might regard the *external rectus* as rotating the globe directly towards, the *internal rectus* as turning it directly inwards, the *superior rectus* as rotating it directly upwards, the *inferior rectus* as turning it directly downwards, while more complicated movements in various directions are effected by the combined action of these with the *superior* and *inferior oblique* muscles.

When a person, with head erect, looks at a distant object directly in front of him and in the horizontal plane, head and eyeballs are said to be in the *primary position*. This is accepted as a sort of standard with which to compare all other positions of the globe.

*Orthophoria* is the term applied to a perfect balance of all the external eye muscles.

Abnormal attitudes of the eyeball are taken in *heterophoria* (muscular imbalance, Gould), *strabismus* (*squint* or *heterotropia*) *pareses* and *paralyses* of the muscles.

### HETEROPHORIA.

In this condition there is merely an *abnormal* tendency to rotation of the eyeball in some one direction. There is no *apparent* defect in fixation and probably there is none, or there is generally none, but *both eyes together look in the proper direction only by the exercise of constant effort*. We detect this condition only by applying tests for its presence. When the tendency is to excessive rotation inwards the condition is known as *esophoria*, excessive rotation outwards, *exophoria*, and of one eye upwards, *hyperphoria*, obliquely, *cyclophoria*.

When the visual lines of *both eyes* fall below the normal plane we have *katotropia* or *katophoria*; when they rise above that plane we have *anotropia* or *anophoria*.

We may have combinations of these, as hyperexophoria and hyperophoria.

The *causes of these defects are mostly congenital and anatomical, i. e., a particular muscle may be either too short, too long, too much or too little developed; it may be imperfectly or unduly innervated* as compared with its antagonist or its fellow, in the work of so rotating the eye as to readily bring about binocular vision with the fellow eye.

*Symptoms.*—It has been found that most heterophorias are in-

directly due to errors of refraction (*we frequently see esophoria associated with hypermetropia and exophoria with myopia*), so that it is not strange that when the muscle defect is present its symptoms are merged with those resulting from the associated anomaly. Yet it is probable that some of the discomfort should be laid at the door of the muscular imbalance. Just as a small amount of hypermetropia or of myopia does not, as a rule, excite symptoms, so a few degrees of heterophoria, particularly defects of abduction or adduction, are of no clinical importance. *In susceptible patients, or where the muscular strain is considerable, we notice especially photophobia, headache, vertigo, mental confusion, theatre and railroad fatigue, "car sickness," as well as other "panorama" symptoms—as Bennett calls them.* In esophoria, where we find *excess* of convergent and *defect* of divergent power, the complaints are nearly always these distance symptoms; for opposite reasons exophoria is commonly responsible for symptoms attendant upon near work, as "mixing up" or "running together" of lines of letters or figures, the blurring or indistinctness of words, written or printed, fatigue on attempting to read, especially in the evening, etc.

*Treatment.*—Correct the ametropia by glasses, being careful to fully neutralize the astigmatism. Give the eyes as much rest as possible, not forgetting meantime to improve the tone of the general muscular apparatus and so, with it, the power of the ocular muscles. de Schweinitz advocates the use of increasing doses of tincture of *nux vomica*, beginning with, say, 5 drops 3 times daily before meals. This acts admirably in many cases of heterophoria.

Howe (*Muscles of the Eye*, Vol. II.) points out that local treatment of hyperphoria and hypophoria should consist principally in the use of prisms. "But it must be admitted that the manner of using them is entirely empirical, inasmuch as we have no means of determining even approximately the nature of a given hyperphoria—that is as we do not know whether this tendency of the eye to turn up is dependent on undue contraction of the levators or on relaxation of the depressors. Evidently, therefore, we must be content in cases of hyperphoria to place the prism or prisms in the position which gives the greatest amount of relief, even temporarily. That is, when we have a right hyperphoria, we prescribe a prism before the right with the base down, or divide the effect with another prism in the opposite direction before the left." *Constitutional Treatment.* As we find frequently that anemia or various toxemias tend to aggravate this condition, indications exist for tonics and out-of-door life. With these,



again, the advantage of exercise is not to be overlooked, and still again mention should be made of the gymnastics suggested by Sargent."

Duane (*Fuchs' Text-Book*, pp. 692, 693) gives the following exceedingly practical directions for the *treatment of heterophoria and squint*: "*Correction of refraction* is a very important element in all these anomalies and may suffice to effect a cure, particularly when the deviation is still of the periodic type. It is of special importance and efficacy in *convergence-excess*, which is developing into squint. Here it is necessary to correct the whole of the hyperopia and astigmatism present. Similarly, in *convergence-insufficiency* accompanying myopia the patient must wear a glass fully correcting his error and wear it for near as well as for distance.

"In cases in which the deviation is no longer periodic—i. e., in which, in addition to a convergence anomaly, there is superadded an anomaly of divergence—correction of the refraction is less apt to afford a cure, and in the case of a continuous squint very rarely does more than diminish the amount of the deviation. In any case, the effect of correction of refraction is rarely an immediate one: it usually takes some months—perhaps a year or two—for the full effect of the glasses to be secured.

*General treatment* must be employed in *neurasthenia* and *hysteria* (q. v.) and in toxemias, or debility from whatever cause. This will often relieve the symptoms without itself producing any material change in the muscular condition of the eyes.

"*Treatment of associated conditions.* The treatment of other affections, particularly intra-nasal disease, which may possibly be reading with a bar or pencil held (vertically) between the eyes and sources of reflex trouble, should never be neglected.

"*Exercise in moving the eyes.* Exercises of the eyes in *converging* on a pencil-point carried towards the nose or in overcoming prisms, base out, are useful in *convergence-insufficiency* and occasionally in *divergence-excess*.

"*Orthoptic exercises.* With a squint that develops early in life much can be done by educating the fusion faculty, with the *stereoscope* or, better still, with Worth's *amblyoscope*. Both of these instruments, by compelling the eyes to act together, train the fusion faculty. Both are at first adjusted for the patient's angle of squint, then by successive adjustments the patient is gradually taught to look into the instruments with the eyes more and more nearly straight and yet maintaining fusion. In this way the angle of squint is steadily diminished, and there is finally orthophoria.

"Another orthoptic exercise is *bar-reading*. This consists in



the print. Unless the patient is using both eyes at once for seeing, the bar will hide some of the letters. The systematic use of the bar is an exercise in binocular vision.

"The squinting eye can also be exercised either by *bandaging the good eye*, or, better, by keeping the latter for some weeks under *atropine*.

"*Prisms for wear*. Deviations of low degree may be corrected by prisms worn constantly, either alone or combined with the lens correcting the ametropia. This is most *serviceable in hyperphoria*. In esophoria and exophoria, prisms worn constantly tend to increase the deviation, and their use is not generally advisable. Moreover, it is not usually possible for a patient to wear more than  $3^{\circ}$ , or at most  $4^{\circ}$ , before one eye, so that the total amount of deviation that we can correct by this means would not be more than  $7^{\circ}$  at most.

"*Operation*. When everything else has been tried and has failed, an operation is indicated.

"With an *esophoria* or *convergent squint*, tenotomy of one, or better, of both internal recti is done, provided the condition is mainly one of convergence-excess. When the condition is one of divergence-insufficiency, the better plan is advancement of one or both externi.

"Similarly, in *exophoria* or *divergent squint* caused by divergence excess, tenotomy of one or, better, of both external recti, is indicated. Cases of convergence—insufficiency, on the other hand, should be treated by advancement of the interni. In marked divergent strabismus tenotomy of one or both externi, combined with advancement of the interni, usually has to be done.

"In *hyperphoria*, if non-comitant, we proceed as for parietic deviations. In a *comitant hyperphoria* the most successful operation is a tenotomy of the superior rectus which should never be pushed so far as to make the muscle parietic or even to produce a moderate over-correction."

*Rhythmic (gymnastic) exercise* of the weak muscles with prisms is of considerable value in many cases, particularly of exophoria. This is continued a few minutes at a time, three times daily, for a month or two until the patient reaches a prism-convergence power, in the manner described, of  $50^{\circ}$  or  $60^{\circ}$ . I am in the habit of giving the patient the following *printed* directions, so that as little time as possible may be wasted in drilling him in the proper use of prism exercise. The blank spaces are to be filled in by the surgeon. The heterophoric patient should return to the oculist two or three times a week for an increase, when that is called for, in the "strength" of his prisms.

**Method of Using Prisms for the Home Exercise of the Eye Muscles.**

"For this are necessary a small candle or gas flame, placed twenty feet distant on a level with the eyes, in a fairly dark room, and the prisms ordered from the optician.

2. Sit squarely, facing the light, with both eyes open and (when these are ordered) wearing the glasses that are used for seeing in the distance.

3. Hold the ..... prism in the right hand with the inner surface touching the eye lashes (or glasses if these are worn) and the thin edge touching the nose; rotate the prism slightly until two lights appear and are seen *on the same level*. Then attempt to fuse the two lights into one image as follows: Hold the left forefinger on a level between the eyes and the light, about ten inches in front of the nose, and while looking intently at the finger-tip slowly bring it nearer until within four or five inches of the nose. Then look up at the light, which should appear single; if not, go through the same movements again until able to see one light *without the aid of the finger*. When the two lights are in this way seen as one the prism should be held before the eye until ten is slowly counted. Then remove it for the same period.

4. These movements are to be repeated for two minutes over each eye three times a day until one light is easily seen the moment the prism is held before either eye. Continue the exercises with this prism for 3 days. Then use for three days more the next strongest, which is ....., obtained by placing the thickest edges of ..... and ..... together. Put a small rubber band around them, to hold them in place and proceed as with the single one. Next, use the ..... and ..... for three days and finally all three together for three days.

**CAUTION.**—Do not use the prisms more than four minutes at a sitting nor if their use causes pain or discomfort. Be sure that the two lights are on the same level before trying to fuse them. The main purpose of these manœuvres is not merely to overcome the highest prism or prisms possible, but to *exercise the eye muscles* with a prism whose double images can be readily overcome. During this period of exercise the patient should consult the oculist as often as directed that he may supervise the treatment of the case."

When these expedients fail an operation, as for squint, is indicated. Prisms for the correction of small degrees of *hyperphoria* are often worn constantly with considerable benefit. The wearing of prisms in *esophoria* or *exophoria* is of doubtful utility and temporary value.

**Heterotropia, "Cross Eyes," Strabismus Squint.**

This has been called "true" or "concomitant" squint, because although the relation of the visual axes is not a normal one it is a *constant* relation—one eye moves about when the other does, and the visual lines always maintain the same angle in all positions taken by the two globes.

In *paralysis* of the muscles, on the other hand, the eyes may be "crossed," but on looking in various directions it will soon be noticed that the visual lines do not preserve this constant relation to each other. One should always exercise the various *excursions* of both globes so as to determine whether or not one is dealing with a case of strabismus or one of oculomuscular paresis. When there is a doubt it may generally be cleared by the *perimeter*. In using the *perimeter* the patient is placed as in measuring the field of vision, with the arm of the instrument horizontal in convergent or divergent squint; vertical in strabismus sursumvergens. A candle light is moved along the arm, from the center outward, until its reflection is seen by the surgeon upon the pupillary center of the squinting eye. The degree marked on the arm of the *perimeter* at this point is the size of the strabismic angle. This observation is taken both for the distant and the near point.

The *symptoms* of both convergent and divergent strabismus result from the associated refractive errors. Apart from the disfigurement this muscle anomaly causes little or no discomfort. For all practical purposes the patient is a one-eyed individual and there is no muscular strain.

*Treatment.*—First of all, after paralysing the accommodation, with atropia or hyoscin (q. v.), the squinting child should be given, for constant wear, and in *spectacle frames*, such lenses as fully correct his refractive error. In addition, *one drop of a two grains to the ounce solution of atropia should be dropped into the fixing eye twice daily for two weeks, the eyes, meantime, being protected from light by tinted "fronts."* The patient may then be allowed to do a fair amount of near work if he have divergent squint, but none at all if he have convergent strabismus.

In the majority of these, the ordinary varieties of strabismus, great improvement or cure will follow such treatment if it be persisted in for six months. During this period the necessity for exercise of the binocular function of vision, by means of the *stereoscope*, or a special arrangement of this instrument called the *amblyoscope*, must not be forgotten. In other words, we desire not only to have the child's eyes appear "straight," but we wish to have him use both eyes together, so far as the vision of the defective eye will permit.

Bradburne (*Ophthalmology*, July, 1908) enumerates the various methods now in vogue for treating and correcting *squint*. He considers it very difficult to develop the fusing faculty in the brain after the child is over six years of age. He mentions several plans: correction of refractive error in order to make the amount of vision equal in the two eyes; occlusion of the fixing eye, to force the deviating eye to take part in vision; instillation of atropine in the fixing eye only, for the same purpose; training the fusion faculty by means of Worth's amblyoscope; the use of Maddox prism, to develop the weak muscles by exercise; operation, to equalize the tension of the muscles, when the lack of balance is too great to be overcome by the foregoing.

If the *cosmetic* or *visual results* are not satisfactory after patiently following the foregoing rules, a resort to operation is indicated. The following precepts will be of value, in most cases: (1) If possible operate only on the squinting eye. (2) Use as an anesthetic a mixture of one per cent. holocain and four per cent. solution of cocain for tenotomies and, if required, a general anesthetic for advancement. (3) Remember that the more a tendon is loosened from its connective tissue and other surroundings the greater the effect of a tenotomy. (4) In *internal* squint, where the convergence is not more than  $15^{\circ}$ - $20^{\circ}$ , a *free* tenotomy of one internal rectus, or an advancement of one external rectus *without* tenotomy of the internus, is usually sufficient. (5) Where the convergence exceeds  $20^{\circ}$  it is better to do an advancement of the external rectus *plus* tenotomy of the internal. (6.) Slight degrees of divergence call for a tenotomy of a single external rectus; marked deviations, for advancement of one or both interni, with or without tenotomy of the external. (7.) *Exercise with the stereoscope, or some of its modifications, should be continued, after operation, for several months.* (8.) When the squinting eye is amblyopic from corneal opacities, cataract, disease of the fundus, etc., and vision cannot be materially improved, the operation should be proceeded with at once—for cosmetic reasons. In such cases we have little or nothing to hope for from atropine, glasses or orthoptic exercise.

#### **PARESIS AND PARALYSIS OF THE OCULAR MUSCLES. OPHTHALMOPLEGIA.**

Although it is clinically useful to speak of these as affections of the *muscles* it is well to remember that it is the *innervation* that is usually disturbed or abolished. If one bears in mind the nerve supply, paralytic diseases of the muscles resolve themselves into well defined groups.

Certain *symptoms* are common to all forms of ocular paralysis. The most important of these is *diplopia*—the patient has a sudden attack of double vision. This occurs in every instance where vision in both eyes is good and is due to the fact that images of objects do not fall on *corresponding* parts of both retinæ. It is by the *relative position* of these double images—a somewhat difficult subject for the student—that most observers endeavor to locate the seat of the paralysis. *Vertigo*, and even *nausea* (the reflex effects of the diplopia) are frequently complained of. *Indistinct vision*, confusion of ideas and *headache* are not uncommon. The patient obtains at least temporary relief from these annoying symptoms by closing one eye or, if the images are not seen far apart, turns his head towards the paralyzed muscle. This latter sign often indicates which muscle is affected.

*Paralysis of the External Rectus.*—Sixth nerve paralysis. This is the commonest of the ocular pareses and is easily recognized.

*Oculo-Motor or Third Nerve Paralysis.*—Any one, two, three, four, five (or all) of the muscles supplied by the third nerve may be paralyzed. Usually, however, there is *ptosis* from implication of the fibres supplied to the *levator palpebræ superioris* with *mydriasis* and *loss of accommodation* due to involvement of the sphincter muscles of the pupil and the ciliary muscle. The paralysis of the other muscles in this group can usually be made out by the loss of rotating power proper to each.

It must not, however, be supposed that it is always easy or possible to say just what muscle or muscles are affected, because of the *secondary contractions* and deviations that occur in *both* eyes, brought about by the efforts of the cerebral centers to accomplish single vision. Various diagrams and tables have been worked out to assist the student in this study by observing the positions and displacements of the two images in a paretic diplopia.

*Causes of ocular paresis* are chiefly *syphilis* and *rheumatism*, either of the nerves themselves or of the bony canals or periosteum that surround them as they pass to the orbit from the central neurons whence they arise. If these organic deposits or growths undergo absorption before too great damage has been done to the nervous elements a cure of the paresis follows, but if as the result of damage to any part of a nerve, alterations take place in its tissues, partial or total loss of function ensues.

When one nerve alone is affected the cause is *probably peripheral*, while a central lesion is to be suspected if more than one are in-

volved. It was pointed out by von Graefe that when fusion of the double images by prisms is easy the lesion is more likely to be peripheral, and *not* cerebral or spinal) than when it is difficult or impossible to obtain and retain single vision. Paralysis of the external rectus is nearly always due to the rheumatic poison or to diabetes. It must be remembered in this connection that *diphtheria* sometimes produces ocular paralysis, especially of the ciliary muscle, and loss of the reading power (*cycloplegia*) with dilated pupil (*iridoplegia*). A more or less *transitory* and *recurrent* paresis of the ocular muscles is a rather frequent and premonitory sign of *tabes dorsalis*.

*Prognosis.*—Diphtheritic, and the early or primary, pareses of locomotor ataxia almost invariably get well, with or without treatment. So do most pareses that depend upon peripheral causes. Even if they are of central origin, and are due to syphilitic exudates that are themselves capable of absorption, the resulting pareses usually, though they do not uniformly, disappear. For obvious reasons the *later* tabetic paralyses remain, as do many others resulting from incurable central lesions.

*Treatment.*—It is proper, especially when the patient goes out, to cover the affected eye with a shield, to guard against the nervous and other difficulties of double vision. Specific treatment should be given when it is indicated, and, even when there is no definite history of rheumatism or syphilis potassic iodide administered in gradually augmented doses, with large quantities of water, is useful as an alterative and absorbent in the majority of instances. It is usually desirable to supplement this medication with the hot pack or Turkish bath, the daily use of saline laxatives and the inunction of mercurial salve. Two weeks of this treatment should be given every month as long as improvement continues.

The faradic or the interrupted galvanic current is of value in paretic lesions, especially when the cause is peripheral, the negative pole being placed, daily, over the closed eyelids (or applied at the insertion of the muscle directly to the cocainized sclera) for five minutes at a time. *Surgical interference*, as in squint, may be resorted to, in selected cases, when medical resources fail. In such operations advancement, with resection of a large portion of the tendon, is most likely to do good.

The hydrobromide of pelletierine, in doses of from 5 to 8 grains, has been recommended in pareses of the ocular muscles with good results.

Howe (*Muscles of the Eye*, II, p. 280) makes the following sen-



sible remarks on the *treatment of ocular pareses in general*. The "*local, non-operative treatment*," says he, "is not very satisfactory. Much has been written in regard to the use of *electricity* for these conditions, but the circumstances under which the interrupted or the constant current is indicated can be obtained much more in detail from any recent book on electro-therapeutics. [See Coleman on this subject.] In certain selected cases this treatment is of some avail. The muscles of the orbit, however, are so far beyond the reach of the ordinary electrodes, that this method fails frequently when it would be followed by good results in parts of the body which can be more easily reached. No matter what the character or strength of the current may be, the routine habit of applying it with a sponge or similar electrode simply in the vicinity of the affected muscle, is unscientific, unsatisfactory, and sometimes worse than useless. Whenever electricity is to be used, after deciding on the character of the current indicated in that case, an apparatus should be selected by which the strength of the current can be exactly measured, cocaine should be applied, the eye rotated if necessary with the fixation forceps so as to bring the paralyzed muscle forward, and the electrode then applied directly over it. The best point for this purpose is flattened and blunt, about six or eight millimeters long and about half as wide. The current should not pass through the globe, if possible, and care should be taken, of course, by frequent examinations, not to have the application too strong."

"As for the *general treatment*, it is evidently impossible to outline what should be done for even a part of the various diseases which produce these ocular paralyses. The all-important fact is that the day of indiscriminate dosing has passed. Modern methods of examination, especially those furnished by bacteriology and chemical analysis, mean more definite diagnoses. That often means serum therapy with its various modifications, it means frequent measurements to ascertain whether our drugs are really producing the effects desired, and it means in general an accurate and careful therapy in place of slipshod guess-work."

"A word, however, should also be added concerning the so-called *heroic doses of potassic iodide and mercurials*. As a considerable percentage of these paralyses are due to syphilitic infection, some practitioners begin in nearly every case with potassic iodide or mercurials or both, and continue them indefinitely in moderate doses. But gradually we have learned two things on this point. The first is



that syphilis is by no means as frequent a cause as older writers supposed; and, second, that if potassic iodide or mercurials are to be given at all, the doses should be gradually increased until the constitutional effects are produced. The amounts sometimes necessary for this are surprising. The uncomfortable symptoms experienced by the patient, or the occasional blame for the attendant producing them, are of little importance compared with what there is at stake in the lasting benefit of the patient."

For the treatment of *Excessive Torsion, Forms of Compound Imbalance* and the various other rare anomalies of the orbital muscles, I would advise the works of Howe, Savage and Hansell and Reber.

### **Nystagmus.**

Nystagmus is a rather rare and curious symptom and may be described as a clonic spasm of the eye muscles due to a variety of causes. It is always associated with defective vision and is seen in multiple sclerosis (q. v.), in *albinos* and in many diseases of the optic nerve and retina. These spasmodic jerkings of the eyeball may be vertical, horizontal, rotary, constant or occasional. Occasionally the patient is conscious of these oscillations, but as a rule his discomfort arises only from the imperfect sight. *Miners* are occasionally subject to the disease, due to the recumbent position and unusual excursions of their eyes, which they are required to continue for hours at a time. This form of nystagmus disappears when the patient relinquishes his work. *Treatment* is usually of little avail. It should be directed towards removal of the cause of the symptom—when that is possible.

It occasionally happens that the irregular motions of the globe disappear or improve with the correction of a refractive error. There are great difficulties in the way of a precise measurement of ametropia in nystagmus—particularly when the defect occurs in children—but it ought to be done with care and the exercise of much patience.

Operations on the eye muscles are of little avail in the great majority of cases, as is the attempt to reach the underlying disease by local or general drug treatment.

### **External Ocular Myositis.**

This is a very rare condition, probably always associated with *tenonitis* or orbital cellulitis. It may result, according to some observers, from gout or rheumatism.

The *treatment* resolves itself chiefly into the therapy of the underlying cause or associated disease. Hot fomentations, leeching, sub-

conjunctival injections of *acoin in oil* (q. v.) will relieve pain and local tenderness as well as hasten resolution of the inflammation.

**Atrophy of the Extrinsic Muscles.**

Sometimes results from myositis and occasionally follows extreme paralysis. Its *treatment* by local injections of *brucine* (q. v.) and the *faradic current* (q. v.) has been recommended.

# CHAPTER XXXIV.

## NON-OPERATIVE TREATMENT OF DISEASES OF THE EYELIDS.

*Introductory Remarks Regarding the Special Chapters on Treatment of Ophthalmic Diseases—Psychotherapy or Mental Suggestion—Importance of a Definite Diagnosis as a Preliminary to All Successful Therapy—The Eyelids—Edema of Lids—Dermatitis Toxicæ—Ecchymosis—Stye—Smallpox of Lid—Seborrhea of the Lid Skin—Tuberculosis—Eczema—Furuncle—Chalazion—Blastomycetic Dermatitis—Small Tumors of the Lid—Xanthelasma—Burns and Scalds—Wounds—Tarsitis—Entropion—Blepharitis Marginalis—Chronic Blepharitis—Blepharospasm—Herpes Zoster Ophthalmicus.*

Although the following chapters will consider the principal points in the conduct of most of the ocular diseases likely to be encountered by the ophthalmologist, one cannot fail to be impressed by the comparatively small space occupied in text-books by a description of the treatment of disease. Remedies are many but the principles of ocular therapy are few. The important consideration—as I have endeavored to impress upon the reader—is not so much the enumeration of remedial agents as the etiologic, diagnostic, pathologic and prognostic considerations that should in each case precede the application of the cure. As soon as we know what we are dealing with it is comparatively easy to treat the case. Such a proportion of textual comment, then, as will be found in this System, is in accord with this idea, and since the ensuing chapters are intended to be an application of those that have gone before, it is to be hoped that the student of ophthalmic therapeutics will not consult the portion devoted to treatment and neglect other sections bearing upon the subject under investigation.

In an attempt to define more clearly the morbid entity it is proposed to treat, the reader will notice that a short excursion is sometimes taken into the domain of its etiology, symptomatology or pathology. For this reason, also, a brief reference is occasionally made to the anatomy and physiology of the tissues and organs under discussion; it may be that a few of these necessary details have escaped the memory of the student.

Even at the risk of being charged with needless reiteration, I have not hesitated to repeat, as often as seems advisable, some formulæ or prescription in both the metric and apothecary systems.

The opinion given in this work as to value of this or that remedy is often the outcome of my own experience. When another is offered it is that of an observer or observers in whose judgment I have as much or more confidence than in my own. It may also be noticed that I have on occasions quoted largely from chapters in other treatises previously written by myself.

Inasmuch as the chapters contributed by the collaborators in the preparation of this System discuss the treatment of many conditions that cannot be justly separated from the therapy of ocular diseases, it is eminently proper that they be read in conjunction with this section devoted to individual affections of the eye. Indeed the conduct of many external and the *majority of intraocular lesions* would be completely empirical without a fair consideration of the chapters written by Drs. Croftan, Hecht, Irons and Brawley, in which the treatment of those general or distant disorders that underlie the lesions that affect the interior of the eye are given at length. This statement is also true of the oculo-muscular pareses and insufficiencies that the ophthalmologist so commonly sees. To assist the student in his quest an elaborate cross-index has been prepared which he is particularly urged to consult.

#### **Psychotherapy.**

*Mental Treatment. Suggestion. Hypnotic suggestion.*

Although additional mention might be made of *psycho-therapy in the treatment of neurasthenic, neurotic and hysterical forms of asthenopia, dysopia and amblyopia*, it was felt both by Dr. Hecht and myself that the successful psychotherapist is born, not made; if he does not unconsciously and naturally exercise that persuasive control over his patients that in all ages has been more or less definitely recognized as a valuable curative asset, no amount of printed verbiage will furnish it. Moreover, a long-continued, faithful and earnest study of diseased eyes, preceded by a sufficient consideration of the anatomy, physiology, pathology and therapy of the organism of which they form a small but far from negligible portion, is the best foundation for that mental treatment which most patients demand and many require. That knowledge may be acquired but the personality of the ophthalmologist is a factor in therapeutics which, although of prime importance, no book or books can do much to modify. Lacking infinite patience, a convincing air, an evident belief in his own powers of healing and a certain kindly sympathy with the patient's troubles the physician, well equipped professionally, cannot apply his remedies to the best advantage and may not hope to avail himself of the powers inherent in applied hypnotism and suggestion.

Of course, proving oneself to be *suaviter in modo* is not the only passport to success in treating the increasing proportion of neurasthenic and neurotic eye patients that crowd our waiting-rooms, but to ignore its importance is to drive many sufferers into the ranks of the Osteopaths, Christian Scientists, Mental Healers, New Thought, *et hoc genus omne*. It behooves us, then, so far as in us lies, to temper our knowledge with what wisdom we possess or may acquire.

In the Introductory chapter something was said about the supreme importance of an *exact diagnosis* before applying remedies in ocular diseases. The subject is so trite and commonplace that one is in danger not only of forgetting that it is a *sine qua non* in ophthalmic therapeutics but, worse than all, of falling into a routine practice of symptomatic treatment. For example, in considering remedies for *conjunctival hyperemia* how opposed to every dictate of experience it would be to treat this sign of twenty different conditions without considering its origin and meaning? It is true that many soothing lotions, a number of cooling compresses, the local application of heat or cold, spraying the nasal passages, etc., will relieve (or perhaps cure) most conjunctival vascular disturbances, but the question of questions is and always must be, to what particular category does the case under review belong?

### THE EYELIDS.

#### Anatomy and Physiology.

The eyeball is partially protected as well as cleansed by the eyelids. These are thin and loose folds of skin, whose inner aspect is covered by the conjunctiva. Between these are found connective tissue plates—the *tarsus*, or so-called tarsal cartilage—to stiffen them and to enable them to retain their form. The lids are closed by the powerful sphincter muscle—the orbicularis; they are opened chiefly by the *levator palpebræ superioris* above and by prolongations from the inferior rectus below.

#### The Eyelashes, or Cilia.

These are in two or three rows and project from hair follicles at the outer margin of the lids. The union of the lids at the nose is called the inner canthus, where is also situated a small, reddish elevation—half skin, half conjunctiva—called the *caruncle*. The temporal junction of the lids is called the *outer canthus*. In each tarsus are some 20 or 30 tubules, the ducts of simple, secreting follicles, called *Meibomian glands*. These produce a lubricating material for the lid edges upon which they discharge their contents.

All the lid structures are well supplied with fat, lymphatic vessels and nerves. A constant mucous secretion from the various conjunc-

tival and other glands moistens and lubricates the anterior ocular structures. The cornea particularly is kept clean and bright from this source, aided by the approximation of the lid edges in winking. This closure of the eye in a cleansing fluid acts like a "window scraper"; it gently removes all deleterious matter from the front of the eyeball and pushes it towards the lachrymal puncta, whence it is drawn by the action of that curious suction apparatus, formed by Mueller's muscle, into the drainage system of the nose.

Inasmuch as the lid skin may suffer from almost every disease that affects dermal tissues elsewhere, it may be said that the ophthalmologist should also be a practical dermatologist. Such diseases as eczema, psoriasis, etc., manifest themselves rather differently in the lids, owing to the presence of other organs than one finds in most other localities of the body and it seems necessary to bear that fact in mind when remedial agents are to be applied. It thus happens that most of the remedies employed by the "skin specialist" have been, at one time or other, patronized by the oculist and this to some extent accounts for the great variety of agents that one reads of as effective in the various forms of palpebral eruptions and the numerous varieties of blepharitis.

#### Edema.

This symptom is generally associated with *injury to the head or local affections of the lids* themselves, such as styes, bites from insects, burns, infective conjunctivitis, etc., or it may be important evidence of a diseased condition of the kidneys, heart or general vascular system.

*Treatment* should be directed to the cause while, locally, benefit is derived from the application of *evaporating lotions* (q. v.), and *soothing collyria* (q. v.).

For instance, Webster Fox (*Text-book*, page 551) advises the following prescription as a frequent application:

R	
Liquor. plumbi subacetatis dil.	7.39 (fl. ʒij)
Tincturæ opii	
Tincturæ belladonnæ āā	5.53 (fl. ʒjss)
Tincturæ arnicæ	30.00 (fl. ʒj)
Aquæ camphoræ	40.00 (fl. ʒiss)
Aquæ dest.	120.00 c.c. (fl. ʒiv)

#### Dermatitis Toxicæ.

##### *Erythema of the lid.*

The eyelids often suffer as a manifestation of poisoning by internal remedies, especially iodoform (q. v.), preparations of *belladonna*, *arsenic*, *potassium iodide*, *mercury*, *turpentine*, *quinine* and other remedies. The *treatment* of all these conditions is the removal of the

cause, the application of a simple *emollient ointment* (q. v.) and the application of an *evaporating lotion*, as in *ecchymosis* (q. v.).

### Ecchymosis.

Constitutes what is popularly termed a "black eye." On account of the exposed location of the eye and the lax condition of the lid skin, contusion with discoloration is more frequent in this location than in any other region of the body.

*Treatment*.—The ordinary black eye, if seen at once, is best treated by cold applications (cloths wet with iced water), or with an evaporating lead lotion:

R	
Liq. plumbi subacetatis	
Alcohol.	āā fōi
Aq. destil.	Oi.

Where a *definite blood-clot has formed within the palpebral tissues*, the common practice of incising the skin and allowing the blood to escape, or applying two or three leeches to the orbital margin is a good one. An antiseptic dressing should be subsequently applied. Unless treatment is resorted to within two days, no remedy will be of use. It is then best to cover up the discoloration with flesh-colored paint. I would advise every practitioner to keep on hand some water colors for this purpose. No production of his artistic hand will be more appreciated than that which disguises such a noticeable blemish.

### Stye or Hordeolum.

Is a very common lid affection and may be regarded as a palpebral boil, situated at the root of an eyelash on the anterior lip of the lid margin. It begins as a small, hard, painful nodule, accompanied by redness and more or less edema of the whole lid, usually runs an acute course, going on to suppuration and rupturing in two or three days.

Styes frequently appear in crops and are recurrent. They are more often seen in young people and are often a sign of disturbance of the general health. In many instances they are a symptom of eye-strain resulting from an error of refraction.

*Treatment*.—In its earliest stage, before pus has formed, the stye may *sometimes be aborted* by pulling out the eyelash, which runs through it, and touching the swelling with *strong carbolic acid* or *tincture of iodine*. If this fails, the point of a Beer's knife, or some similar instrument, should be pushed into the center of the tumor and its contents evacuated.

For *aborting styes* the following mixture has been recommended:

R	
Hydrarg. iodidi rubri	0.40 (gr. vii)
Ol. olivæ	100.00 (fl. ʒiii¼)



This should be applied several times daily to the incipient sty.

In the *recurrent forms* of the disease smearing the lid edges daily for three months with the following has been advised:

℞

Aristol.	0.50 (gr. vii ss)
Petrolati	
Lanolin.	āā 5.00 (gr. 5iiss).

Lanvole recommends for this purpose, also, bathing the lids regularly with:

℞

Acid. salicylic	5.00 (5 iiss)
Boracis	3.00 (gr. xlv)
Aquæ dest.	30.00 (fl. 5j).

For *recurrent attacks of styes* Lanvole finds the following mixture of decided value:

℞

Ammonii chloridi	1.00 (gr. xv),
Sulphur. precip.	3.00 (gr. xlv),
Spt. camphoræ	20.00 (fl. 5v).
Aquæ rosæ	50.00 (fl. 5iiss).

The lids are to be regularly bathed with this wash two or three times daily for several weeks.

Warm fomentations or hot stupes may be applied to relieve the pain and promote suppuration, and in a day or so a mild mercuric ointment should be rubbed over the diseased part:

℞

Hydrarg. oxid. flav.	gr. ii
Cosmolin.	5j

This ointment promotes healing of the abscess and has a tendency to prevent a recurrence of the disease. Careful search should be made for *errors of refraction which should be corrected by suitable glasses*. The general condition often calls for attention in these cases, and treatment should be especially directed to digestive disturbances. Pil. calcii sulphid., gr.  $\frac{1}{2}$ —1, *freshly prepared*, three times daily, is often of great value.

Frequently, as in anemic girls, a course of iron, with proper diet and fresh air, is chiefly needed. A useful tonic in many instances is:

℞

Tinct. ferri chlorid.	
Acid. phosphoric. dil.	āā 5iiss
Tinct. rhei	5j

Quinin. sulph.	gr. iii
Liq. strychniæ	f̄ss
Syr. simplicis. ad	f̄viii

Take half a teaspoonful in water before meals.

Theobald also (*Text-book*, p. 514) suggests that *styes may be aborted* by the application to them of pure *carbolic acid*. The point of a tooth-pick is dipped into the acid, and insinuated as far as possible into the infected follicle which can be generally recognized upon the lid margin. Care should be taken to prevent the phenol getting into the eye. Theobald further recommends that the patient apply with the finger top *every half hour* to the external surface of the lid *over the sensitive area*, the following solution:

R

Zinci sulph.	2.00 (gr. xxx)
Aquæ dest.	30.00 (fl. ʒi)

Care should be exercised not to let this solution enter the eye.

R. L. Randolph remarks (p. c.) that styes frequently come in crops and one who has ever had a stye can usually tell from the sensitive tender spot on the lid that one is coming before it presents any external evidence. The most reliable and at the same time painless application is a solution of zinc: sixteen grains of sulphate to one drachm (not ounce) of water. It should be prescribed in a small bottle and, with the end of the finger moistened, applied to the sore area, which will nearly always disappear over night. It should be applied every half hour or so during the day, care being taken not to bring it in contact with the conjunctiva as unnecessary irritation and discomfort will be occasioned.

#### Smallpox of the Lids.

This condition is usually accompanied by more or less conjunctivitis. The integument is often covered with the papules and the lid is swollen and edematous. The *itching* present is generally relieved by the application of *benzoated lard* or *unguentum aquæ rosæ*. It is said that an efficient means of relieving this troublesome complaint is by the use of the *red rays* (see *Phototherapy*) that also prevent pitting. The *formation of pus* and the subsequent infection of the pustules may be avoided by the use of *tincture of iodine applications* and cleansing the skin with *bichloride ointment*, (q. v.).

#### Urticaria.

*Hives of the lid.*

This is not a very common form of palpebral eruption. Its treatment is practically the same as for erythema—removal of the

cause and a soothing application—*liq. plumbi subacetatis with alcohol* and cold water, for example.

### **Seborrhea of the Palpebral Skin.**

Generally affects the upper eye-lid. It may, however, be seen in various forms in both lids. The treatment is the application of *oleate of mercury* (q. v.) in ointment form.

### **Palpebral Chromidrosis.**

*Seborrhea nigricans.* Vulgarly termed "*black-heads.*"

This dark-colored collection in diseased sweat-glands occurs mostly in anemic girls. It is best treated by attention to the general health of the patient, the expression of the glandular deposits and the local application of a mixture of *liquor plumbi* and glycerine.

### **Tuberculosis of the Lid Skin.**

Is not a common affection. It occurs in the shape of eroded, shallow ulcers with irregular margins. Crusts form which when removed expose a granular surface. The treatment is that of local tuberculosis generally, the exhibition of *tuberculin* (q. v.) and *curtting* or *excision of the growth.*

### **Eczema of the Lid Skin.**

I refer to that variety which is independent of eczematous, ciliary blepharitis and is usually associated with eczema of the face and scalp. It may also be set up by belladonna or any of its preparations (q. v.).

*Treatment.* de Schweinitz points out (*Text-book*, p. 196) that this should depend upon the character of the eruption. If it be *vesicular*, a useful application is a *drying powder* composed of starch, oxide of zinc and camphor; if crusts have formed, these should be removed with as little bleeding as possible and with the aid of an alkaline solution, maceration of the epidermis being avoided.

An ointment should then be applied either of *ichthyol*, benzoated lard, oxide of zinc (q. v.) or equal parts of oxide of zinc and vaseline to which 20 grains of calomel have been added; or subnitrate of bismuth in an ointment. Itching is relieved by the application of *lotio nigra* (q. v.) followed by zinc ointment. If the disease assumes a chronic type, some preparation of *tar* (q. v.) may be applied. Good results follow the use of *aristol ointment*, both in subacute and chronic cases. de Schweinitz further remarks that constitutional remedies, quinine, iron and strychnia, are recommended, and arsenic, if the type is chronic. Proper regulation of diet, an occasional saline laxative, and good hygiene are important measures.

Intercurrent conjunctivitis should receive appropriate attention but it must be remembered that *watery* compresses or washes applied to the palpebral skin are contraindicated in this affection.

**Furuncle of the Lids.**

This is a localized, dermal inflammation due to purulent infection, occasionally seen on the eyelids. The best treatment is hot, boric acid compresses followed by *early incision* and the use of an antiseptic ointment—either White's (q. v.) or *salicylic acid, one grm. to 40 of petrolatum*.

**Chalazion.**

Meibomian cyst is a *small, hard, slow-growing and slightly movable tumor* embedded in the tarsal cartilage. Its treatment is almost entirely operative but some surgeons believe that when the cyst is small it may be prevented from enlarging or may be made to disappear by the use of *massage with certain ointments*, e. g., *brown ointment* (q. v.). Treatment of the causes of the growth, generally some of the forms of blepharitis, is always indicated.

**Blastomycetic Dermatitis.**

This appears as a rare, chronic, infective, pustular area in the form of numerous wart-like, discharging and exceedingly minute abscesses. The use of the *X-rays with curetting of the diseased areas*, associated with the *internal use of large doses of potassium iodide*, seldom fails to bring about a cure.

**Warts and Other Small Tumors of the Palpebral Skin.**

*Zinc chloride paste* is sometimes employed as an escharotic in removing warts, small lupoid growths, epitheliomata and other deposits in the lid skin. The Middlesex Hospital (London) Pharmacopeia has the following *paste of zinc chloride*. It is prepared by first making *liquor zinci chloridi cum opio* as follows:

℞

Zinci. chloridi	℥xvi
Pulv. opii.	℥iss.
Acidi. hydrochlorici.	fl. ℥vi
Aquæ bullientis	ad Oi

Macerate the opium in 12 oz. of the boiling water for 12 hours, add the acid and filter, then dissolve the chloride of zinc in the filtered liquid and make up to 20 oz. with distilled water. To the foregoing mixture *flour* is added to render it of proper consistence as follows:

℞

Liq. zinci chlor. cum opio	fl. ℥i
Farinæ	gr. cxx

Mix smoothly in a mortar and heat over a water-bath until of a proper consistence.

It should be applied to the growth and kept *in situ* by a plaster

for 24 hours, after which a slough forms and with it the tumor comes away.

Warts of the palpebral skin may be removed by the application of *glacial acetic acid*. This is an anhydrous, crystalline form of the acid which liquefies at 60° F, into a colorless fluid with a strong vinegar odor and a pungent, acid taste. It should be applied with care, as it is a powerful caustic and may involve a wider area than the diseased growths.

The application of *fuming nitric acid* (q. v.) is also very efficacious in the removal of warts. Having scraped the superficial epithelium from the surface of the papilloma, carefully apply the acid to the denuded surface with a wooden tooth-pick or match. In a few days this proceeding should be repeated until the growth slowly crumbles away. If done with care no scar results.

#### **Xanthelasma.**

##### *Xanthoma.*

This tumor is a flat, smooth, *yellowish deposit in the palpebral skin* due to alterations in the superficial muscle fibres. It occurs as an irregular, round or oval patch, or patches, near the inner canthus and commonly affects the upper lids of elderly females. It is a *benign growth* which rarely calls for interference except for cosmetic reasons, when the following may be used:

R

Hydrarg. bichlor.

5i

Collodion.

5iii

Apply with a camel's hair brush.

An eschar forms in a few days, which finally falls off, leaving a faint scar. The X-rays also constitute an effective remedy.

S. B. Muncaster (p. c.) advises the use of *monochloracetic acid* (q. v.) for the removal of this disease. A solution of one part to two of water is applied by means of a piece of cotton on the end of a tooth-pick. A few seconds after the application the yellow discoloration *becomes white*. On the second day there is swelling; in about a week or ten days a scab forms and falls off, leaving a clean surface without any scar. In some cases it is necessary to make a second or, perhaps, a third application at intervals of four to six weeks.

#### **Burns of the Eyelid.**

Scalds and burns of the lids are treated like these lesions elsewhere. They should be cleansed with antiseptic solutions, protected by non-irritating ointments and their consequences relieved by subsequent operation. It is well to cover the burned area as soon as possible with gauze soaked in *carron oil*. This should be changed twice a day and

when secretion becomes marked, or if the surface should be infected, *xeroform* (q. v.) *aristol*, or some other substitute for iodoform (q. v.), should be dusted over the burn.

Picric acid ointment (q. v.) is also highly recommended.

### Wounds of the Lids.

Under the title "*Lotio rubra*" Lawson (*Text-book*, p. 539) suggests the following wash to be used as an external application in *wounds of the eyelids*:

R	
Zinci sulph.	gr. i
Spt. rosmarini.	
Tinct. lavendulæ comp. āā	m. xv,
Aquæ dest. ad	fl. ʒi

### Gangrene of the Lid.

Malignant pustule due to the *bacillus anthracis*, *diphtheritic infection* and other forms of disease causing gangrene of the lid skin are rare conditions. When present they are to be met by incisions, hot, antiseptic (1:2000 sublimate) compresses and the treatment of the cause—as the use of *antitoxin in diphtheria*.

### Tarsitis .

Inflammation of the tarsus is generally found in *syphilitic subjects* and causes much thickening and deformity of the lid and lid margins. The *treatment* is of the general dyscrasia or other cause of the disease, together with the application of *yellow oxide ointment*, (q. v.) and *collyria* containing boric acid and bichloride. The latter should also be used as a detergent wash and there is no better formula than the following:

R	
Hydrargyri bichloridi	.0009 (gr. 1/75)
Sodii chloridi	.972 gm. (gr. xv)
Acidi borici	1.296 gm. (gr. xx)
Aquæ camph.	
Aquæ dest.	āā 45.00 (fl. ʒjss).

### Entropion.

This is an *inversion of the edge of the lid*, generally associated with trichiasis (q. v.) and turning in of the eye-lashes. The *treatment* is almost exclusively operative, although the spasmodic variety may be relieved by *painting the skin with collodion*, or the solution of iodoform in that menstruum, and by applying strips of adhesive plaster to draw the lashes away from the eye-ball.

### Trichiasis.

The drug *treatment* of this condition is by no means satisfactory.

The *incurving hairs* may be removed by means of epilation forceps, and when they are not numerous they may be destroyed and further operation postponed or avoided by one or both of the following simple measures, which can hardly be dignified by the term surgical operation:

First—*Michel's method, electrolysis.* A platinum needle is connected with the negative pole of a 20-volt battery, and plunged accurately into the ciliary follicle, the positive pole being grasped by the patient. The action of the battery is evidenced by the disengagement of (hydrogen) gas from the neighborhood of the follicle.

Second.—*Snellen's method.* Thread a sharp and small needle with both ends of a fine silk thread. Enter the former at the base of the cilium, push it underneath the palpebral skin, and bring it out six or eight millimeters from the lid margin. As the double thread is drawn through, ensnare the lash and draw it bodily into the substance of the lid.

Solitary "*wild hairs*" may be effectually destroyed by first enlarging, with the aid of a loup and the end of a sharp-pointed hardwood tooth-pick, the hair follicle and thrusting into the opening the same tooth-pick previously soaked in *strong nitric acid*. The preliminary boring is made by a careful rotary motion of the wooden "drill." There is no bleeding; pain is prevented by cocainizing the eye and the globe is protected by thoroughly swabbing the lid after this procedure with a 5 per cent. solution of soda. The eyelash generally drops out within 24 hours and if the operation is skilfully performed the follicle is entirely destroyed at one sitting.

When from one cause or another (usually from long standing trachoma or granular lids), the preceding measures are found or judged to be inadequate for the cure of the entropion and trichiasis, a more radical operation is necessary.

#### **Blepharitis Marginalis, or Tinea Tarsi.**

*Blepharitis ciliaris. Sycosis tarsi. Blepharitis ulcerosa.*

This may or may not be a true eczema of the border of the lids; indeed the disease may be regarded as a *varying manifestation of a number of different conditions* both local and general and it requires some experience to *apply treatment because successful therapy depends upon accurate diagnosis.*

However, there are several agencies that should always be employed in the conduct of the majority of these cases. Inasmuch as the disease is frequently found in poor, ill-nourished and strumous children that fact should be borne in mind in the conduct of such cases. It also occurs in those whose occupations expose them to



wind, dust and other irritating influences. *Errors of refraction* and defects in the muscular balance of persons who constantly use their eyes for near work and in a bad light are likely to cause suffering from the milder forms of this affection.

*Treatment* should first of all be directed toward the *removal of the crusts*. Very few patients persevere in this endeavor as they should, and it is, accordingly, often a wise measure to *remove with the forceps every eyelash that harbors the scabby exudations*. This prevents the reformation of the crusts, gives the remedies employed a better chance to reach the seat of the disease and set up healthy action in the parts affected. The best way to remove the crusts is to soak them well with a hot, 2 per cent. solution of sodic carbonate. After removal of all scabs an ointment of yellow oxide of mercury should be thoroughly rubbed into the edges of the closed lids:

℞	
Hydrarg. oxid. flav.	gr. ii
Ungt. aquæ rosæ	ʒi

This may be done in the evening, shortly before retiring, while a boric acid solution should be applied several times during the day:

℞	
Acid. boric.	
Sodii boratis	āā gr. xv,
Aq. rosæ	fl. ʒii,
Aq. dest.	fl. ʒi.

When the case is one of *eczema*, with moist crusts, swelling of the lids, and conjunctivitis, various measures have been advocated. Benzoyated lard alone, or with the addition of oxide of zinc, is a useful application:

℞	
Zinc. oxid.	gr. vi
Adepi benzoat.	ʒi

Patients suffering from blepharitis should avoid dust, heat and wind as much as possible and should wear protective glasses when they leave the house. They should not themselves smoke, nor allow their eyes to be irritated by remaining in a smoking-room. The general health is worth looking after; indeed, it may be that a strumous diathesis lies at the bottom of the disease, for which cod-liver oil, arsenic, iron, etc., may be necessary.

If a *blepharitis* be *perpetuated by eye-strain, glasses or other proper treatment should be ordered*, especially if there be any astigmatism present. Whatever the treatment may be, a complete cure is not, in the majority of cases, to be expected inside of several months.

The majority of cases improve with the application of *yellow ointment* (q. v.) and other greasy salves. Mild, detergent lotions (see *Acid boric*) and soothing collyria containing holocaine are indicated. Mild emollients (q. v.) and dusting powders (q. v.) should also be employed. James Moores Ball (*Text-book*, page 165) recommends the following:

R

Cocain.	gr. x
Bismuth. subnitratis	ʒss
Cerat. simplicis	ʒj

Internally the following may be prescribed:

R

Acidi arsenosi	gr. j
Pulvis piperis nigri	gr. ii
Extracti gentianæ	q. s.

Fiant capsulæ No. xxx

One capsule after each meal.

In *blepharitis ciliaris*, or *squamosa*, the lid margin is reddened and the interciliary spaces filled with whitish scales like dandruff. There is also an ulcerative form where the lashes are matted together with dried yellow crusts which on removal expose a raw surface. Nearly all these varied forms of blepharitis are accompanied by a conjunctival infection which should, of course, be treated in conjunction with the lid disease.

A. Duane (p. c.), following in the main a prescription of H. Knapp directs the patient, first, to lather the eyelashes well as if he were going to shave them off; then to wash out the soap with tepid water, pulling the eyelashes at the same time, so as to remove any loose ones; then to dry the lids and apply yellow salve with gentle friction to the roots of the lashes; then to remove all excess of salve, so as not to leave the lids greasy.

In the usual forms of the disease F. B. Eaton (p. c.) advises soaking the lids with a saturated solution of sodic bicarbonate in warm water and thoroughly cleansing the palpebral margins. If there are any raw areas about the eyelashes these are touched with a 1 to 2 per cent. solution of silver nitrate on a probe and cotton. This treatment is followed by the application at night-time of the following mixture:

R

Olei cadini	fl. ʒss
Olei theobrom.	
Petrolati āā	ʒss

J. F. Klinedinst (p. c.) advises the following formula:

R̄

Hydrarg. oxidi flav.	gr. viii
Ichthyol.	gr. 10-30
Petrolati	
Lanolin. āā	̄iv

Apply to eye-lids at night.

When there is *irritation from the yellow oxide ointment* or other preparation Percy Friedenbergl (p. c.) orders the lids to be washed with pure castile soap, then carefully dried and the following salve applied at night with massage:

R̄

Ichthyol.	0.20
Resorcin.	0.30
Lanolin.	5.00
Ungt. aquæ rosæ	5.00

M. W. Ward (p. c.) prefers in the majority of cases of marginal disease the following prescription:

R̄

Hydrarg. ammoniat.	gr. iii
Petrolati alb.	̄ ii

Rub into the eye-lashes three times daily.

Hanford McKee (p. c.) has abandoned the use of yellow oxide in blepharitis and uses instead of it a mixture of *ichthyol* and *oxide of zinc ointment*.

J. W. Ingalls, (p. c.) prefers:

R̄

Acidi borici	̄i
Ung. adrenalin.	̄ii
Petrolat. alb. ad	̄ ii

To be applied to the lids at night.

### Chronic Blepharitis.

In *chronic blepharitis marginalis of the seborrheic form* Melville Black, (p. c.) has been successful in eradicating the disease after other methods had failed, by having the patient come to his office daily so that he could himself soften the scales with hydrogen peroxide applied with a cotton wound tooth-pick and then carefully remove every scale with a foreign body spud. Many of them surround the lashes and have to be unstrung like beads. This should be done under a Jackson's binocular head magnifier. He then rubs in some 25 per cent. argyrol with a cotton-wound tooth-pick and allows it to

dry. If care is taken to confine its application to the margin of the lid it does not look very badly. The patient is instructed to use the yellow ointment at night.

Webster Fox (*Text-book*, p. 551) advises the use of boroglyceride for *blepharitis* in the following ointment:

℞		
Sol. boroglycerid.	25 per cent.	0.610 (mx),
Ung. aquæ rosæ.		3.88 (3j).

Fortunati (5) recommends *thigenol* (q. v.) for *eczema of the lids* in ointments of 5 to 10 per cent.; *blepharitis marginalis*, 10 to 50 per cent.; *blepharitis ulcerosa*, 10 per cent. It is applied to the edges of the lids, while gauze smeared with the salve, from 10 to 60 per cent., should be left on all night. The next morning after these applications the lids are carefully cleansed with an alkaline solution and pure *thigenol* used. The results of this treatment are excellent, a cure sometimes resulting in 25 to 40 days.

de Schweinitz (*Text-Book*, p. 214) finds the plan of Koenigstein a valuable adjunct in the treatment of the accompanying hyperemia of the lid margins. A small watering pot with a "rose" attachment is filled with water (to which a little *eau de cologne* is added) at 68° F. and the contents allowed to play for several minutes over the closed eyelids. This application will be found grateful to most patients with congested lids. (See *Sprays*.)

When it is of the *eczematous type* H. M. Lokey (p. c.) advises the following prescriptions:

℞		
Acid. carbolic.		gr. ii
Sol. adrenalin. (1:1000)		gtt. xxx
Enzymol. ad.		fl. ʒj

℞		
Zinc. oxid.		
Acid. boric.	ʒā	gr. xx
Ungt. adrenalin.		gr. xxx
Vaselin.		
Lanolin.	āā	ʒiv.

The wash is to be applied to the lids with a cotton swab and the lid edges anointed with the salve.

von Schlen (50) advises the following formula in *blepharitis eczematosa*:

℞		
Ichthyol.		0.03 gm. (gr. 1/2)
Amyli, zinci ox.	āā	10.0 gm. (ʒiiss)
Vasellini		25.0 (ʒvi, gr. xxv)

Another formula by Michel is:

℞

Ichthyol., zinc ox., gelatini	āā 5.0 (gm. (ḡj 1-3)
Glycerini	
Aquæ dest. āā	25.0 c.c. (fḡvi. mxxv)

Sig: The ointment for the lids to be warmed before applying.

Fick's formula for moist, eczematous patches on the lids probably produces some zinc salicylate:

℞

Zinc oxidi	1.0 (gr. xv)
Acid. salicylic.	0.1 (gr. iss)
Vasellini	10.0 (ḡiiss)

Kummerfeld's lotion (q. v.) is applied as compresses or used as eyewater at night in the *home treatment of blepharitis*. The formula is:

℞

Camphoræ	0.40 (gr. vi)
Lactis sulphuris	4.0 (ḡi)
Aquæ calcariae (P. G.)	
Aquæ rosæ	āā c.c. 40.0 (fḡj 1¼)
Gum acaciæ	0.9 (gr. xii)

The following formula is also useful in *acne palpebrarum*:

℞

Sulphuris	1.0 (gr. xv)
Camphoræ	
Olei olivæ,	āā 0.6 (gr. ix)
Unguenti rosati (P. G.)	15.0 (ḡss).

In the form of ointment, *tar* (q. v.) is used in *squamous blepharitis* and *other dermal* affections of the lids. One of the best formulæ I know is that with white precipitate:

℞

Hydrarg. precip. alb.	0.5 (gr. viiss)
Picis liquidæ	2.0 (ḡss)
Petrolati	8.0 (ḡii)

Mix thoroughly.

F. C. Hotz (p. c.) uses *instead of yellow oxide ointments* the following:

℞

Ichthyol. ammon.	gr. v
Zinc. oxid.	



three nights. When the *marginal lesions do not readily heal* or respond to other treatment the ulcers should be curetted, after which they should have applied to them:

R

Hydrarg. iodidi rub.	1.00 (gr. xv)
Ol. olivæ	250.00 (fl. ʒviii).

As Jackson points out, that one may procure permanent results in the *treatment of chronic blepharitis*, especially of children, the ointment and other remedies should be continued for several months after an apparent cure has been affected.

In *obstinate cases* of this affection, S. J. Bumstead (p. c.) has found nothing equal to the following prescription:

R

Cupri sulph.	
Ichthyol.	āā gr. viii
Petrolati.	ʒi

This must be applied more carefully and less freely than the usual yellow oxide ointment and, if found too irritating, ought not to be used oftener than every second or third day.

#### **Blepharitis Pediculosa.**

(*Phthiriasis*) and other parasitic diseases are uncommon in this country but when discovered may be successfully treated by picking out the pediculæ or other parasites by means of forceps and lens and subsequently rubbing in *sulphur* or White's *ointment* (q. v.).

#### **Blepharospasm.**

This form of *tonic or clonic spasm of the orbicularis* is due to a great variety of different pathological conditions, but is most frequently observed in the phlyctenular keratitis (q. v.) of children. Its *treatment* naturally varies with the cause of the complaint. In children effective, but harsh treatment of *persistent spasm* is in holding the head *beneath an irrigator or water tap*, allowing ice cold water to flow with slight force over the closed eye-lids. In addition stretching the lids with elevators or other instruments is effective.

R. D. Gibson (p. c.) instills a single drop of a four per cent. solution of cocaine into the eye, to prevent undue irritation of the parts, and follows this with *the introduction of an eye speculum* to expose the eye to the light and air for a period varying from three to ten minutes once per day. The setscrew of the speculum may be advanced a little at a time until the full tension of the spring is exerted in stretching the lids wide open.

Speville (*Clinique Ophthalmologique*, May, 1906), reports a case cured by hypodermic injection of 1 cc. of 80 per cent. alcohol.



Valude (*Wiener Medizinische Wochenschrift*, July 28, 1906) also injected 80 per cent. alcohol in the region of the facial nerve (where it emerges from the stylosmastoid foramen) in two cases of blepharospasm in which no local cause could be detected. The site of injection was behind the ear close to the anterior wall of the auditory canal; the needle was directed obliquely downward, and was made to enter deeply into the structures for about 2 cm. until it reached the styloid process and then was drawn backward along the temporal bone up to the opening of the mastoid canal where the facial nerve emerges. It is of advantage to add cocain to the alcohol, 1 c. c. water,  $\frac{1}{2}$  c. c. alcohol, and 1 centigram of cocain. The immediate result of the injection is a paralysis of the facial nerve; this paralysis, however, disappears quite rapidly and with it the blepharospasm.

#### **Congenital Anomalies.**

The treatment of such conditions as *coloboma*, *symblepharon*, *epicanthus*, *cryptophthalmus*, *congenital entropion* and *ectropion* is exclusively surgical, and has no place in a work of this kind.

*Elephantiasis*, *xeroderma pigmentosum*, *leprosy*, *lupus vulgaris*, *ankyloblepharon*, *symplepharon*, *milium*, *molluscum contagiosum*, *lagophthalmus*, *blepharochalasis*, *sebaceous cysts*, *alopecia of the lids*, *distichiasis*, *blepharophimosis*, *ectropion*, *ephidrosis*, *carcinoma*, *sarcoma* and other neoplasms of the lid are also pathological conditions that are either unaffected by non-surgical treatment or their proper conduct lies distinctly within the province of the operator.

#### **Syphilitic Lesions of the Lid.**

Whether these be *primary*, as *chancre*, secondary, tertiary or hereditary dermal syphilides, they are to be treated exactly like luetic skin diseases of the same class elsewhere. It must be remembered that it is not difficult to mistake a suppurating stye or chalazion, *lupus vulgaris*, the benign form of *blepharitis ulcerosa* or even an ulcerating tear-sac for several kinds of specific ulceration of the palpebral skin.

#### **Herpes Zoster Ophthalmicus.**

Is accompanied by severe pain limited to the course of the branches of the ophthalmic division of the fifth nerve. The filaments supplied to the cornea are frequently involved. The treatment of the eyelid involvement in this serious and painful disease is mostly symptomatic, requiring remedies for the *neuritis*, as well as the exhibition of general tonics and stimulants. Morphia hypodermically, dusting powders of *xeroform* when the blebs have opened, preceded by *ichthyol* or other ointment when seen early enough are among the commonly accepted remedies.

Terson\* claims that the antiseptic, alterative, anesthetic, analgesic action of *guaiacol*\*\* is of service in this disease. As an application to the skin a 10 per cent. solution in oil or glycerin, either alone or in combination, in oily solution, with camphor or menthol, will be found useful.

Easily confused with the serious diseases is one not quite so grave—the *palpebral eruption of ordinary facial herpes*. The *treatment* is about the same as for ophthalmic herpes, especially ichthyol and attention to the concurrent conjunctivitis.

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\**Die Ophthal. Klinik*, 2, 1906.

\*\*GUAICOL, (*Monomethylcatechol*; *Methyl ester of protocatechin*), made from beechwood creosote by fractional distillation; is a faintly yellow, limpid, *oily liquid* with an aromatic odor. It is insoluble in water.

Another preparation is in *crystalline form*, soluble in oils and slightly soluble in water; used in the same dose and for the same purpose as the preceding.

## CHAPTER XXXV.

### TREATMENT OF DISEASES OF THE CONJUNCTIVA.

*Hyperemia of the Conjunctiva—Acute Catarrhal Conjunctivitis—Chronic Catarrhal Conjunctivitis—Vernal Conjunctivitis or Spring Catarrh—Phlyctenular Conjunctivitis—Trachoma or True Granular Lids—Operations for the Relief of Trachoma—Ophthalmia Nodosa—Conjunctival Lithiasis—Non-Gonococcal Conjunctivitis.*

#### **Hyperemia of the Conjunctiva.**

This "dry catarrh" of the ocular mucous membrane is generally symptomatic of inflammation in the surrounding tissue and often arises in conjunction with chronic or acute conjunctivitis.

*Treatment.* For its relief the causative or associated affection should be treated and a soothing collyrium applied as often as is necessary.

*Errors of refraction should be corrected* and all irritating influences removed. The patient should work in good light, removed from a smoke or dust-laden atmosphere, and the eyes should be protected from wind. Lachrymal obstruction or *abnormal conditions of the nasal passages should be treated.*

de Schweinitz points out that gout or other causes of vasomotor disturbances may underlie this symptom and if this is proven to be the case the patient should be treated by anti-lithemic methods, ergot, nux vomica or other suitable remedies.

*Cold fomentations* applied to the closed eye-lids three or four times a day are very soothing and grateful to the patient, especially if there be sensations of smarting or burning. These should be applied in the following manner: A basin is filled with cold water at a temperature of about 40° F. The patient is instructed to fold a small face towel about twelve inches long and three or four wide, an end of which is grasped in each hand. While the face is held over the basin, with the eyes closed, the towel is dipped into the cold water and the dripping towel applied to the closed lids, forehead and temples. This is repeated 10 seconds for a period of from three to five minutes. The application should be stopped if it makes the eyes or head ache.

In a few cases *very hot water* (applied in the same fashion) is more effective and more grateful than cold. Both may be tried and the more pleasant one adopted.

Following the application of cold (or hot) water several drops of a soothing, non-irritating solution should be instilled into the conjunctival sac. The following will be found to be very acceptable:

R

Acid. boric.	
Sod. boratis.	āā 5ss
Aq. rosæ	5ii
Aq. destil.	f5ii

Edward Jackson prescribes for chronic *conjunctival hyperemia* without much discharge, especially the form in which the larger vessels on the inner surface of the lid appear to be swollen and more numerous than normal, a weak solution of tannin like the following:

R

Tannin	1.00
Glycerin	5.00
Aquæ dest	500.00

If the lids are gummy or show a tendency to adhere in the morning a little simple ointment should be gently rubbed on the eyelashes just before retiring at night. Either simple lard (without salt), benzoated lard, cold cream or cosmoline will act nicely. When the conjunctiva looks dry and glazed more stimulating lotions are indicated, such as:

R

Zinci sulph.	gr. i-ii
Aq. destil.	f5i;

or brushing the lid with a ten per cent. solution of argyrol, or one-fourth per cent silver nitrate two or three times a week is advised.

R. L. Randolph (p. c.) regards the following collyrium of the greatest service:

R

Sod. boratis	gr. x
Aq. camph.	5ii
Aq. dest. ad	5i

A few drops in the eyes every four hours.

Randolph has used this eye-water for nearly twenty years and finds it still covers the widest ground of any of the so-called eye-washes for inflamed conjunctivæ. It is absolutely unirritating and helpful. He uses it more than any other collyrium and nothing has supplanted it in his estimation.

In cases of hyperemia of the conjunctiva W. O. Moore (p. c.)

uses a few drops of a 1 *per cent.* solution of antinosine instilled into the eye three times a day. Solutions should be kept in a dark bottle and in a cool place.

Instead of using *cherry laurel water* some ophthalmic surgeons prefer a collyrium made up with *dilute hydrocyanic acid*, of which the following is a fair example, useful in *conjunctival hyperemia*:

℞

Acid. hydrocyanic. dil.	gtt. i
Acid. boric.	℥ ss.
Sod. boratis	gr. xl
Aquæ dest.	fl. ℥ii

E. C. Boyd, (p. c.) prefers as a simple collyrium *one drop of formalin in four fluid ounces of distilled water* to be used in an eye-cup several times a day.

H. V. Würdemann (p. c.) uses the following collyrium:

℞

Suprarenalin. (1-1000)	3.00
Sodii boratis	0.50
Chloreton.	0.06
Sol. sodii chloridi (0.75 per cent) ad	30.00

Put two drops into each eye several times a day.

A. Duane (p. c.) prefers the following:

℞

Acidi. boric.	
Sod. borat. āā	0.50
Aquæ camph.	
Aquæ dest. āā	7.50

O. Wilkinson (p. c.) uses the following mixture in all simple catarrhal irritations, congestions, and inflammations:

℞

Acidi. borici.	
Sodæ borat. āā	gr. vi
Aquæ camph.	fl. ℥i
Aquæ dest. ad	fl. ℥i

Mix and filter. The patient may use this *ad libitum* for home treatment.

S. J. Bumstead (p. c.) pertinently remarks that these cases, although often apparently simple, frequently baffle us, partly because of conditions which we are unable to control and partly because they are associated with exophoria and other muscular defects that cannot be completely cured. Sometimes they will be found associated with

nasal affections. Under such circumstances he has given relief by using, say, once a day this lotion:

R

Acid boric	gr. xv
Aquæ camphoræ	ʒi

Add to this  $\frac{1}{2}$  to 1 dram of a  $\frac{1}{2}$  grain to ounce *solution of sulphate of eserine*. Best use a drop at bedtime, because if the eserine should contract the pupils it will disappear by morning. It will often be possible to use it also in the morning if it does not affect the pupil too much. As the susceptibility to this remedy varies, the patient should be instructed to dilute the medicine in case of excessive action. It is also more than probable that this drug spurs the internal recti muscles to greater activity which in some cases may have a permanent value.

Edward Jackson (p. c.) uses for a feeling of irritation in the eye recurring frequently with little discharge, and not much hyperemia, the following:

R

Zinci sulph.	0.50
Acid boric.	15.00
Aquæ dest.	500.00

It is well to warn patients against the use of *poultices* of bread and milk, bread and water, bran, tea leaves, boiled turnips, cabbage or potatoes, as well as of scraped, raw vegetables, as these popular remedies are not only useless but almost always aggravate the various hyperemias and inflammations of the lid and conjunctiva for the relief of which they are ignorantly prescribed.

#### Acute Catarrhal Conjunctivitis.

*Catarrh of the conjunctiva. Simple ophthalmic conjunctivitis.*

This may be regarded as an aggravated form of hyperemia of the conjunctiva, generally due to infection and chiefly characterized by a mucous or mucopurulent discharge.

It may also be a symptom of various exanthemata—measles, scarlet fever, small-pox—in which it is sometimes called *exanthematous conjunctivitis*.

The disease usually begins with sensations of smarting and burning of the lids and a feeling of sand in the eye. The discharge, at first serous, soon becomes muco-purulent and accumulates in the form of flakes in the retrotarsal folds. The lids stick together in the morning, while dried secretion is found adhering to the margins of the lids and to the eyelashes. The conjunctiva lining the lids is also seen to be slightly swollen and red. As evening approaches there is increased

discomfort, accompanied by some photophobia in the bright sunlight or when in a lighted room. Lachrymation is usually present, the tears carrying off some of the discharge.

The conjunctival vessels on the globe are in most cases enlarged, but, in the milder types, there is no marked redness of the ocular conjunctiva, the thickening and redness being confined to the conjunctiva of the lids, particularly at the junction of the lids and the eyeball in the retrotarsal folds. Sometimes there is a slight chemosis present, in which cases the nutrition of the cornea is liable to suffer, and ulceration may take place not only from pressure upon the vessels in that region but, following infection, from the discharge retained in the sulcus.

*Treatment.*—In acute catarrhal conjunctivitis the *cause should be searched for* and all sources of irritation removed. Mild antiseptics should be used for cleansing purposes, such as solution of boric acid (gr. 15 to oz. 1), or bichloride of mercury 1-10,000. Cold applications should be used every two or three hours in the manner described in the treatment of hyperemia of the conjunctiva, to be followed by the instillation of four or five drops of the following solution:

℞

Acid. boric.

Sodii bor.

āā gr. xv

Sol. hydrarg. bichlor. (1-10,000) ad f. ʒi.

At night this salve to the lid margins:

℞

Acid. boric.

Lanolin.

āā gr. x,

Vaselin alb.

ʒss.

In the first stage a solution of adrenalin or suprarenalin, 1-10,000, is also beneficial.

*As the acute stage subsides* more stimulating lotions may be used with advantage by the surgeon, especially a weak solution of nitrate of silver painted on the lids:

℞

Argenti nitratis

gr. ii

Aquæ destillatæ

f. ʒi.

In the *acute, contagious varieties of conjunctivitis catarrhalis* cold or iced applications may be applied every two hours. These are best employed as small pads of absorbent cotton, or lint, kept cold on a block of ice and transferred to the closed lids every few minutes. They are to be discontinued as the acute stage subsides. The eyes should be



*irrigated every hour or two with an antiseptic solution: boric acid gr. 15 to the ounce, hydrarg. bichlor. 1-10,000; or with a formalin solution 1-6,000. Painting the everted lids once a day or every other day with a 1 per cent. solution of nitrate of silver is indicated after the acute stage has somewhat subsided and when the discharge becomes thicker and more profuse. It should be applied well up in the retrotarsal folds. Protargol, or argyrol, 10 to 20 per cent. solutions, may be used in lieu of the silver nitrate and is quite beneficial in many cases. It has the advantage of being less painful, but perhaps is not as reliable as the silver salt.*

*Cold cream or vaselin should be applied to the lids at night. As the affection is contagious extreme care should be taken that no others are infected. The patient should, in severe cases, be isolated and no one allowed to use towels or handkerchiefs that have been handled by him or used on his inflamed eyes.*

A laxative should be administered at the commencement of the disease.

With many ophthalmologists the following is a favorite collyrium:

R

Sodii boratis	
Acid. boric āā	gr. x
Aquæ laurocerasi	fl. 5i
Aquæ test.	fl. 5vii

A few drops in the eyes frequently.

#### **Simple Catarrhal Conjunctivitis.**

As Peters\* so aptly says, nothing seems at first sight so easily treated as a simple, chronic catarrh of the conjunctiva. The patient generally consults, first of all, his family physician, who is likely to order a zinc sulphate collyrium for the relief of the burning and smarting and to reduce the conjunctival hyperemia. As this remedy is a specific in the diplobacillary form of the disease it may cure the patient's ill. How often does its employment aggravate the symptoms!

Even to the experienced and educated ophthalmologist the exact etiology of many instances of this affection, however well differentiated clinically, is not so easily determined. It behooves us, then, to make, by all means in our power, a careful examination of the case in all its various aspects, refractive, bacteriologic, systemic, nasal, extra-ocular and intra-ocular until we have convinced ourselves that we are able to place the disease in its proper pathological class.

Lowenstein (*Klin. Monatsbl. f. Augenheilkunde*, July, 1908,) has

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\**Zeitschr. f. Augenheilk.* Nov., 1907.

successfully treated staphylococcus and streptococcus conjunctivitis with *pyocyanase*, a vaccine made from old *pyocyaneus* cultures of a proteolytic enzyme that possess marked bactericidal properties. By means of a medicine-dropper the conjunctival sac was thoroughly irrigated with Lingner's (Dresden) *pyocyanase* about twice a day. In this and other forms of superficial infection the effect was prompt and good; in gonorrheal and other deep-seated affections, as well as in diplobacillary disease, the disinfection was not so thorough and took a longer time.

In all forms of this disease J. H. Claiborne (p. c.) uses *eye-sprays* as an adjunct to other treatment. He everts the lid and allows a few drops of a two-grain-to-the-ounce solution of silver nitrate to roll over the exposed mucous membrane, which he then sprays thoroughly with a solution of *cocaine*, about  $\frac{1}{4}$  of a medicine dropper full of a two to four per cent. solution and 15-30 drops of *borolyptol*\* to an ordinary spray-tube of water. In the summer he uses ice water and in the winter warm applications. He then instils a drop of adrenalin chloride, 1-1000. At times he substitutes (particularly in women) 1 grain to the ounce of nitrate of silver and in very sensitive cases he uses only the borolyptol, cocaine and adrenalin, supplementing this with appropriate treatment at home.

To many people the spray is delightful; to others it is disagreeable. He uses about 20-30 pounds pressure—less if complaint is made. On trial he finds that he uses about 15 drops of cocaine solution and the same amount of borolyptol.

He also prescribes a spray at home which in nervous people he believes is easier to use than drops. He tells the patient to pull down the lower lid well and look up while someone else sprays the following into the cul-de-sac freely, three or four times a day:

R

Cocain. hydrochlor.	gr. i
Sodii bibor.	
Sodii chlorid āā	gr. v
Sol. adrenalin chlorid. (1-1000)	fl. ʒi
Aquæ dest. ad	fl. ʒi

\* **Borolyptol.**

This mixture is said by the proprietors to contain "5 per cent. Aceto Boroglyceride, 0.2 per cent. Formaldehyde in combination with the active antiseptic constituents of *Pinus Pumilio*, *Eucalyptus*, *Myrrh*, *Storax*, *Benzoin*." The label also indicates the fact that it is made up with 8 per cent. alcohol.

When an *astringent is indicated* Percy Friedenbergr (p. c.) prefers one or the other of the following prescriptions:

R

Glycerin. acid. tannic.	2.00
Aquæ lauro-cerasi.	3.00
Sat. sol. acid. boric.	15.00

R

Tinct. myrrhæ	1.00
Aquæ rosæ	6.00
Sat. sol. acid. boric.	15.00

When there is considerable secretion I\* have found that *freshly powdered thioform* (q. v.) flecked with a camel's-hair brush upon the cleansed conjunctiva acts very nicely.

#### Chronic Catarrhal Conjunctivitis.

Linn Emerson (p. c.) makes use of the following formula, two drops to be instilled into the eye three times daily:

R

Acidi. tannic.	
Sod. borat.	āā gr. x
Glycerin.	fl. 5i
Aquæ camphor. ad	fl. 5i.

In the various forms of *catarrhal conjunctivitis* Hirschberg uses plain solutions of *zinc sulphate* with distilled water, from 1:1,000 to 1:100 according to the desired astringent effects.

It may, of course, be combined with other adjuvants and correctives. For example:

R

Zinc. sulphatis	0.5 (gr. vii)
Tinct. opii	1.0 (gtt. xv)
Aquæ dest.	150.0 (fl5iv, fl5v)
Aquæ fœniculi	50.0 (fl5j, 5jss)

Some years ago I drew attention in *Hare's Therapeutics* to the use of sodic sulphate as a cleansing lotion for *acute catarrhal conjunctivitis with secretion*, but I have not since seen a reference to its employment in the local treatment of eye diseases. I then advocated the following:

R

Sodii sulphatis	5.00 (5ii gr. xv),
Sol. sodii chlor.	(1:100) 250.00 (fl. 5viii).

It should be used warm, four or five times daily.

\*Casey Wood. *Hare's System of Therapeutics*, III., p. 663, 1901.

T. S. Middleton (p. c.) orders the following ingredients to be made up into four tablets, one or two of which are to be dissolved in an ounce of boiled water and used as a *collyrium* and *compress* in the home treatment of *simple catarrhal conjunctivitis*.

R

Acid. boric.	℥ss
Sodii chlor.	gr. xii
Aquæ camphor.	
Aquæ menth. pip. āā	m. xvi

This method insures freshness of the solution.

Peters\* believes that of *chronic conjunctival diseases* the most important is *infection with the diplobacillus*, more especially on account of the frequent corneal complications it induces. It may cause few objective symptoms, the patient first seeking advice for failure of vision due to the high cell-content of the secretion from the conjunctiva. The diplobacillus is so ubiquitous that the secretion should be examined, not only in acute but also in chronic conjunctivitis, so that *zinc*, the *specific in this infection*, may be employed. Peters finds nothing better than his zinc-ichthyol ointment, which has the following formula:

R

Ammon. ichthyol.	15.0
Zinc. oxidi	5.0
Vaselin. alb.	0.15

He finds that zinc sulphate, although generally successful, sometimes proves disappointing. In *pneumococcal infections*, not depending upon dacryocystitis, Peters always orders a compress of iodine trichloride, 1:2,500, but here, again, in chronic cases, zinc-ichthyol ointment is very useful.

Many cases must be regarded as modified trachoma, especially is this the case with *conjunctivitis sicca*, in which trachoma bodies and adenoid tissue can be found; but until the cause of trachoma has been discovered, we can expect no further light on the subject.

Silver nitrate and copper sulphate are useful *in reducing a hypertrophied, engorged*, conjunctiva, acting chiefly as caustics. In this respect protargol fails, and is unsuitable for chronic cases. If in spite of the treatment mentioned, a feeling of a foreign body in the eye and of heat remain, it is necessary to scrape the lid thoroughly under cocaine. This procedure generally gives great relief,

\*Review in the *Ophthalmoscope*, Mar., 1908.

which often lasts for months. If necessary, the operation can be repeated.

In cases which seem to depend upon an undue excitability of the nervous mechanism, and which are associated with neuralgia of the supraorbital, the following is useful:

R̄

Secal. cornut.	1.0
Quinine hydrochlor	2.0
Ferri sulph.	3.0
Ext. gent. q. s. ut fiat pil. 100	

Two pills three times a day.

If this fails, tincture of eucalyptus will almost certainly allay the asthenopic symptoms.

In *simple catarrhal conjunctivitis, both acute and chronic*, W. O. Moore (p. c.), uses the following prescription:

R̄

Acid. boric.	
Alum. et potass. sulph.	āā gr. vi
Aquæ dest.	fl. ʒii

These drops may be used at least three times daily.

McGillivray believes that in the acute stage and in mild types of simple catarrhal conjunctivitis there is no remedy equal to frequent instillations of a 10 per cent. argyrol solution. In the severer types, 25 per cent. solution should be employed, especially in those cases that are on the borderland of purulent conjunctivitis. The discomfort experienced in these cases is relieved instantly after the instillation, the discharge becomes rapidly checked and recovery is obtained, as a rule, without the least discomfort to the patient. The treatment should be applied every two or three hours, or oftener, if the discharge is plentiful. If the affection does not go on to complete recovery, as sometimes happens, but passes into the subacute or chronic stage, where there is little or no discharge, argyrol is useless, and its place should at once be taken by any of the older collyria. It is during the catarrhal or purulent stage of conjunctival affections that argyrol is not precipitated by the sodium chloride of the tears, so that simple instillation is all that is necessary, provided the patient holds the chin higher than the forehead, to enable the fluid to find its way into the upper *cul-de-sac* by gravitation. The head should be held in this position for a full minute or so after the instillation, during which time the patient should wink freely, to allow the solution to become diffused over the whole conjunctival surface. When the patient sits up it is a good plan to get him to blow his nose freely, so as to flush out the tear ducts.

In *acute catarrhal conjunctivitis* the following formula with Glauber's salt (q. v.) will be found useful:

℞	
Sodii sulph.	5.00 (3j gr. xv)
Sol. sodii chloridi (1 per cent.)	250.00 (℥viii)

To be instilled warm four or five times daily.

In *both the acute and chronic form of this affection* C. R. Holmes (p. c.) uses the following collyrium, dropped into the affected eyes once or twice daily. In the milder forms of the diseases he decreases the amount of the alcohol, zinc and ammonium one-half, reserving the full strength for the chronic cases.

℞	
Camphoræ	gr. i
Spirit. vini. rectific.	gtt. x
Zinci sulph.	gr. ii
Ammon. mur.	gr. iii
Croci hispan.	gr. ¼
Aquæ dest.	fl. ℥i

W. K. Butler (p. c.) believes that *antipyrine* has an anesthetic effect in certain mixtures and uses it in conjunctival catarrh with irritative symptoms. He thinks that it may be substituted for the objectionable cocaine, so commonly prescribed. Either of the following may be used, as indicated:

℞	
Antipyrin.	0.06
Acid. boric.	0.60
Aq. dest.	32.00

Or,

℞	
Zinci. sulph.	0.03
Antipyrin.	0.06
Acid. boric.	0.60
Aq. dest.	32.00

R. H. Johnston (p. c.) prefers as a collyrium Horst's Eye Water (q. v.) which, by the way, is highly recommended by Fuchs. This mixture will be found described under topical applications.

#### Simple Acute Conjunctivitis.

A collyrium used in *acute conjunctivitis* and other inflammatory diseases of the external eye is Sattler's eyewater:

℞	
Acid. salicylic.	1.0 (gr. xv)

Acid. boric.	15.0 (ʒiij gr. xlv)
Aquæ dest.	500.0 (fl. ʒxvi).

G. E. Dean (p. c.) uses the following collyrium in subacute *conjunctivitis* and in other diseases of the conjunctiva with profuse and purulent discharge:

℞	
Fluid ext. hydrastis, U. S.	m. iv
Glycerini	m. xl
Aquæ dest. ad	fl. ʒi

T. W. Moore (p. c.) often prescribes the following formula in inflammatory conditions of the conjunctiva, whether the increased secretion be purulent or not:

℞	
Aquæ hamamelidis.	10.00
Cocainæ hydrochlor.	0.20
Sodii chlor.	0.65
Aquæ rosæ ad	30.00

Three drops in each eye three times daily. To this he sometimes adds adrenalin chlor. solution (1:1000) 4.00 c. c.

Panas advised the employment of *beta naphthol* as a lotion in the second stage of simple acute conjunctivitis:

℞	
Betanaphthol.	1.00 (gr. xv)
Alcohol, q. s.	
Aquæ dest.	1000.00 (Oij)

#### Vernal Conjunctivitis.

*Spring catarrh. Phlyctenula pallida. Frühjahr's catarrh. Periodic plastic conjunctivitis. Sclero-corneal fibroma.*

Spring catarrh is an affection of childhood and adolescence. It is active only in spring and summer and is apt to recur year after year. The palpebral conjunctiva usually presents a more or less velvety appearance and is covered with a bluish gray film, although in some cases this condition is absent. The ocular conjunctiva sometimes presents a peculiar thickening and grayish, elevated infiltrations at the corneal margin. There is considerable irritation, the patient complaining of itching and smarting with a desire to rub the eye. Lachrymation and photophobia in a bright light are, as a rule, also complained of. Discharge is rarely a symptom. The disease subsides with the advent of cold weather.

*Treatment.* If possible the patient should be removed to a cooler climate or to cooler surroundings. Daily massage with a 2 to 10 per



cent. ointment of *salicylic acid* has been recommended and has proved to be beneficial in some cases, but no remedy can be entirely relied upon to give the desired result in every case.

Relief is obtained by applying cold or iced compresses frequently during the day, followed by cleansing the conjunctival sac with a 15 grains to the ounce solution of boracic acid. Yellow oxide of mercury ointment (gr. 4 to oz. 1) should be applied between the lids on going to bed. For the protection of the eyes from light, wind and dust, medium-tinted, smoked glasses or goggles should be ordered. The general health should be looked after and tonics prescribed if necessary. Frank Allport reports two cases permanently cured by the X-rays.

Ball (*Text-book*, pp. 261-262) advises that the eyes be bathed in hot boric acid solution and that the ointment of ammoniated mercury be rubbed into the eye once or twice a day. Van Millingen employed a solution of acetic acid (q. v.) 1 to 20 drops to the ounce and this remedy has been successfully employed by others.

Wicherkiewicz recommends the use of a 10 per cent. collyrium of *antipyrine* (q. v.) and believes it has a specific effect on the disease.

L. Webster Fox (*Pennsylvania Medical Journal*, December, 1907,) is convinced, from an experience of twelve years with the operative procedure of Jocqs, that the sooner this operation is performed after a diagnosis has been positively established, the quicker is a permanent cure obtained. If the disease has run a long course, he has recourse to a more extensive tarsectomy. In cases refusing radical treatment, he employs two drops of a solution made of ten drops of *acetic acid* to four fluid ounces of distilled water, three times daily; adding five drops each day until a smarting sensation is produced. *Chinosol* (q. v.), *chlorine water* and *dionin powder*, as suggested by Pyle, may be additionally used in order to give temporary relief.

W. C. Posey (*Annals of Ophthalmology*, Oct., 1907,) reports an unusual case of vernal conjunctivitis. A young colored woman had suffered from vernal conjunctivitis since childhood. Her corneæ gradually became involved until vision was reduced to 1/1x in the right and 2/1x in the left eye. The corneæ were surrounded by a slightly elevated zone of yellowish white tissue and their transparency destroyed throughout by irregular opacities, which seemed to be made up of a hyaline degeneration of reduplicated epithelial and sub-epithelial elements. The center of each cornea appeared to be avascular but numerous small vessels extended over the limbus from the surrounding conjunctiva. The *treatment* was massage of the cornea with ointments of increasing strengths of yellow oxid of mercury

and dionin. Pilocarpin,  $\frac{1}{2}$  gr. to the ounce, was used twice daily. The eyes were also steamed several times daily with hot vapor. Under this treatment the ocular condition gradually improved, the corneæ became less injected and the eyes quiet, with vision of 5/1x.

Axenfeld (*Société française d'Ophthalmologie*, 1907,) has written a monograph on this subject in which the treatment is fully discussed. Bearing in mind the theory that the cause of the disease may lie in the *ultra-violet rays* of summer light he proposes the protection of the eye from this form of light by having the patient wear glasses filled with a fluorescent substance like solution of quinine sulphate.

Change of climate and especially removal to a high altitude generally acts well, although in some instances, however, Axenfeld advises internal treatment, based upon a blood examination, and finds that arsenical and ferruginous preparations are especially valuable.

For the relief of the local troubles and to prevent the occurrence of connective tissue formation he prescribes a 1 to 3 per cent. solution of boric acid, white precipitate ointment, and, particularly for the relief of the intolerable itching of the disease, one drop of strong *acetic acid* in 10 to 20 ccm. of water. With these *ice water compresses*, and last but not least, instillations of adrenaline.

When the secretion is excessive it frequently shows many eosinophiles so that the usual astringent remedies, *zinc, copper sulphate, silver nitrate, etc.*, are not well borne and should not be used. In this contingency some advise protargol but more reliance is to be placed in operative procedures. Axenfeld has not found results from ichthyol or dionin; massage with yellow salve and white precipitate is to some extent useful. In the severer examples of the palpebral form surgical interference seems called for. The simple removal of the *plaques* does little good; it is better to follow it by thorough cauterization. Other observers do cauterization alone, repeated scarifications, thorough brushing (*brossage*) with 1:1000 sublimate and electrolysis, Kuhnt's operation, the removal of the tarsus, as in old trachoma, is a rational proceeding in chronic cases with marked connective tissue *plateaux*.

The hard exudates at the limbus do not as a rule call for surgical interference unless it is to remove one or two for diagnostic purposes. The *condition of the lachrymal apparatus* and nasal cavities should always be determined and necessary treatment applied.

Bock reports cases in which powdered iodoform gave excellent results. R. L. Randolph advised a one per cent. solution of salicylic acid (q. v.) which is also to be used as an ointment.

J. G. Thompson (p. c.) highly recommends the following:

R

Acid. boric.	3iss,
Magnesiæ calcin.	℥ ss,
Aquæ dest.	fl. ʒiii

Mix and filter. Put a few drops into the eyes every three or four hours.

George S. Derby (p. c.) has found *pollantin* of considerable value in vernal catarrh. It allays the irritation of the disease, although it has no curative effect. E. Gruening and others have used the same remedy and speak highly of it.

J. A. Pratt (p. c.) has used finely powdered boric acid, dusted upon the conjunctival elevations, and subsequently rubbed in by massage of the lid upon the eye-ball. He reports marked improvement from this treatment.

W. K. Butler (p. c.) advises the following to be applied once or twice daily:

R

Quiniæ hydrochlor.	0.10-0.30
Vaselin. alb.	10.00

#### Toxic Conjunctivitis.

*Atropine conjunctivitis.* Conjunctivitis from *eserine*, *aniline*, *chrysophanic acid*, *duboisine*, *homatropine* and *hyoscine*.

The foregoing titles sufficiently indicate the etiology of this form of conjunctivitis. The *treatment* consists, first of all, in the removal of the cause, followed by mild astringents associated with cold fomentations. If the conjunctiva becomes granular and thickened a half per cent. alum wash applied freely three times a day will be found efficacious.

#### Conjunctival Lithiasis.

*Chalk deposits in the subconjunctival tissues.*

This is a cretaceous degeneration of secretion in the Meibomian tubules and glands. *Treatment.* The deposits should be removed with a small Graefe knife-point and the lids massaged daily for a week or so with *brown ointment* (q. v.).

At the same time a boric acid collyrium should be used three or four times daily. The cause (gout, rheumatism, chronic conjunctival catarrh) should be determined and treated.

#### Ophthalmia Nodosa.

This title denotes a peculiar formation of nodules in the conjunctival tissues due to the entry of caterpillar hairs. The disease resembles miliary tubercles and may end in violent inflammation of the cornea and intraocular structures.

Valude\* records a typical case of ophthalmia nodosa in a patient who was treated successfully by *scraping the diseased areas* and by antiseptic dressings.

Salva\*\* reports a case accompanied by deep infection of the uveal tract with closed pupil and secondary glaucoma. In spite of repeated paracentesis, iridectomy became necessary. This was followed by permanent lowering of the tension. Subsequent attacks of cyclitis yielded to subconjunctival injections of sodium salicylate, leaving the eye with a visual acuity varying between 0.2 and 0.3.

#### **Phlyctenular Conjunctivitis.**

*Phlyctenular ophthalmia. Scrofulous or strumous ophthalmia. Eczematous conjunctivitis. Lymphatic ophthalmia or conjunctivitis.*

Phlyctenules of the conjunctiva are characterized by the formation of small elevations or pimples, which are sometimes *true tubercles*.

*Symptoms.*—This disease is *one of childhood* and usually sets in with smarting and burning of the eyes and excessive lachrymation. At the same time the patient exhibits an intense sensitiveness to light. The child buries its head in the mother's lap or in a pillow and seeks dark corners of the room to get away from the light. The lids are tightly closed (*blepharospasm*) and any attempt to open them is met with decided resistance. The photophobia and blepharospasm, when marked, are due to the *disease affecting the cornea*, (q. v.) which often becomes involved early in the disease.

Frequently accompanying phlyctenular conjunctivitis is an *eczematous eruption behind the ears, on the face and at the corners of the mouth and nose*. The cervical lymphatic glands are commonly enlarged. The child generally presents a strumous appearance. *Blepharitis* (q. v.) is frequently present and *fissures are likely to form at the outer angle of the lids*. The ocular conjunctiva is usually congested, especially when a number of phlyctenules are scattered over the conjunctival surface. Where there are only one or two pimples the injection is confined to a leash of blood vessels running to the phlyctenule.

The *phlyctenule consists of a small, solid, reddish elevation*, made up of a collection of lymphoid cells beneath the epithelial layer of the conjunctiva. In a short time the epithelium becomes destroyed and an ulcer forms. The phlyctenule usually appears on the conjunctiva in close proximity to the corneal margin and as a rule the disease extends to the cornea forming ulcers, a description of which will be given

\**Annales d' ocul.* 134. July, 1905.

\*\**L'Optal. Provinciale*, Sept., 1905.

later. *Fresh attacks frequently occur, new phlyctenules appearing on other portions of the conjunctiva before the first outbreak has disappeared.* As long as the disease is confined to the conjunctiva it is not serious, so far as interference with vision is concerned.

It is usually found in children of the poorer classes who are badly nourished and brought up in unhealthy surroundings, and may be regarded as an eczema of the eye due to an attempt of nature to get rid, in an eruptive fashion, of some morbid blood product.

Nias and Paton,\* by measuring the fluctuations produced in the opsonic indices in their cases, believe they can give support to the idea that infarctions of dead or attenuated tubercle bacilli are the causative factors in *phlyctenular conjunctivitis*.

Their results are based on an examination of 50 cases, in which 200 samples of blood were examined.

They find that the blood of a patient with phlyctenular ophthalmia is markedly deficient in opsonic power to the tubercle bacillus, but not to other bacteria, such as the staphylococcus, at the outset; but if the patient be adequately treated the opsonic index rapidly rises and reaches a maximum coincidently with the healing of the ulcers. Then it falls rapidly and in a few days is below the normal. At this low figure it will remain for an indefinite time and if a relapse occurs, the same sequence of phenomena will be reproduced. In a minority of cases, generally older and more vigorous subjects, the opsonic index as regards tubercle will be found to have risen much above the normal. Here it will remain with temporary falls till healing occurs and then takes a terminal drop. There was not a single exception to the above course of phenomena.

Tuberculin was not used in treatment because it would vitiate the results.

*Treatment.*—Although in their various manifestations phlyctenules of the conjunctiva do not differ essentially from the same disease in the cornea, it is, perhaps, desirable to take up their treatment under separate headings. On the other hand, unless one is dealing with corneal ulcer in this connection, the therapy of phlyctenular conjunctivitis does not much differ from that of phlyctenules of the cornea.

The *general health* should be carefully attended to. The *diet* should be regulated, giving the child plenty of fresh milk and eggs. Meat should not be allowed more than once a day and in the majority of cases it should be avoided altogether. Pastry, candy, and sweets of

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\**The Lancet*, Dec. 1, 1906. (From the abstract in *Annals of Oph.*)

all sorts should be prohibited. The child should be kept in the open air, and, if possible, should have a healthy environment. Tinted glasses should be worn to protect the eyes from excessive light, from wind and from dust, but bandages should not be applied.

The tests for *tuberculosis* should be applied and if the nodules are found to be tuberculous treatment should be directed toward them.

Small doses of *calomel* or *gray powder* should be given to regulate the bowels while tonics, especially arsenic and iron, are generally indicated. *Syrup of the iodide of iron* and cod liver oil are often required, Maitland Ramsay is much in favor of minute doses of tartar emetic.

The nasal passages usually require attention, as a chronic rhinitis is frequently present—another manifestation of the lowered condition of the general health.

The *local treatment is important*. If blepharitis be present all crusts should be removed from the margins of the lids, first softening them by bathing in warm soda water and then applying an ointment of the yellow oxid of mercury in vaselin, gr. 2 to 5 to the ounce. This should also be placed between the lids at night. The same ointment may be applied with benefit to the eczematous patches on the skin and at the angles of the mouth and nose. A weak solution of nitrate of silver ( $\frac{1}{2}$  to 1 per cent. solution) painted on the fissures at the outer angle of the lids, as well as on the excoriations at the angle of the mouth and nose, is also of benefit. The blepharospasm (q. v.) may be relieved by cold applications. Cleansing of the conjunctival sac with a solution of boric acid (gr. 4 to oz. 1) will assist in keeping in check the congestion of the conjunctiva.

C. S. G. Nagel (p. c.) everts both lids and, the cornea being protected by the apposition of the upper and lower mucosa, *irrigates both exposed surfaces with a  $\frac{1}{2}$  to 2 per cent. solution of silver nitrate*, immediately afterwards flushing the parts with sterile water. This procedure is repeated as often as is necessary with whatever strength of the silver salt the condition of the parts seems to call for. He believes with Pflüger, who originated the plan, that it is the most effective local application that can be made in this disease.

F. C. Hotz (p. c.) always gives, according to the age of the patient, the 1-10 to the 1-5 of a grain of calomel with  $\frac{1}{4}$  to  $\frac{1}{2}$  grain of subcarbonate of iron. These ingredients are made up with a grain of sugar of milk, the whole to be taken three times daily.

As Jackson points out (*Text-book*, p. 264) when there is *serious photophobia* (blepharospasm) fissures in the skin of the lid near the outer canthus are generally present and greatly aggravate the trouble. These should be touched either with glycerite of tannin or with a one or two per cent. solution of silver nitrate (as mentioned above).



In the *blepharospasm* of this disease W. O. Moore, (p. c.) prefers the internal administration of the *fluid extract of conium*, 5 to 10 drops four times daily.

### **Trachoma.**

*True granular lids. Chronic ophthalmia or blennorrhœa. Granular conjunctivitis. Egyptian ophthalmia.* Vulgarly and improperly termed "*granulated*" lids.

This serious infection of the conjunctiva and other ocular organs, is usually treated from the standpoint of the *acute or recent* and the *chronic forms*.

Although it has been divided into various stages by many authors, chiefly on clinical grounds, it must be remembered, in considering the therapeutics of trachoma, that from the date of the first infection to the period of cicatrization the stages of this disease overlap one another so that it is often difficult to classify a given example of it.

The conduct of a case of trachoma, in whatever condition it presents itself, requires as much tact, patience and good judgment on the part of both doctor and client, as it demands a knowledge of ophthalmic therapeutics on the part of the former. A brief review of the chief pathological conditions to be encountered in the course of an ordinary case of trachoma, together with our ideas of treatment, is described in my joint work with T. A. Woodruff, as follows:

Trachoma is a very serious, contagious, intractable and destructive disease of the eye, characterized by the *formation of minute nodular growths (granulations) in the conjunctiva which in time become absorbed, leaving cicatrices to mark the site of the new growths.*

The *recent form of the disease* exhibits great swelling and injection of that portion of the membrane covering the globe, in which case the enlarged papillæ may be hidden by the swollen tissues. It is usually accompanied by discharge that is sometimes purulent in character. Ulcers, from infection, may form on the cornea, when lachrymation, pain and photophobia are prominent symptoms.

The *chronic form of trachoma* is more frequently met with and may set in without any marked discomfort, the patient complaining of nothing more distressing than itching, foreign body sensations or a slight smarting of the lids, these symptoms being aggravated when the eyes are exposed to wind, dust or prolonged use.

As the disease advances the symptoms gradually become more pronounced. On everting the lids their conjunctival surfaces will be found covered with a number of irregularly scattered granulations, more abundant in the upper lid and particularly in the retro-tarsal folds. These granulations are grayish white, somewhat resembling



sago grains, are embedded in the conjunctiva and project above its surface.

The base of the granulation consists of connective tissue which eventually constitutes the cicatricial degeneration of the conjunctiva and indicates its locality. The disease, in the course of months or years, *finally involves the tarsal cartilage*, the granulations disappear and deformity of the lids is a frequent result. This is due to cicatricial contractions, producing *entropion*. The bulbs of the eyelashes become affected, so that they grow irregularly and *trichiasis* results. After this atrophy of the granulations, the under surface of the lids again becomes smooth, but is shiny and intersected by a number of whitish lines showing where the conjunctiva has been replaced by connective tissue.

Other complications not infrequently arise. The ocular conjunctiva becomes congested and a vascular condition of the cornea occurs, bringing about a condition called *pannus*, *which is nothing more or less than the extension of the trachoma to the cornea*. The upper portion of the cornea is generally the first to suffer and is covered with vessels derived from the conjunctiva, which run between the epithelial layer and Bowman's membrane. The portion of the cornea affected is usually covered with a diffuse opacity, which may clear up entirely if the course of the disease is arrested.

As de Schweinitz (*Text-book*, p. 287) points out "granular lids are liable at any time to take on acute symptoms; increased discharge; exacerbation of pannus; with clouding and ulceration of the cornea; hyperemia of the iris; and acute pain over the brow," so that the surgeon may be called upon at all stages of the disease to change, modify or arrest treatment.

If the disease progresses *the whole cornea may present this same picture of vascularization and opacity* and its surface may be covered with a dense whitish membrane that may leave permanent opacities. In old-standing cases the weakened cornea may be unable to resist the intraocular pressure and, bulging forward, produce a *staphyloma*. As before stated, ulcers of the cornea may form, leaving cicatrices which permanently interfere with vision.

Trachoma is undoubtedly a *contagious disease* and is doubtless due to a *micro-organism*, that (probably) *has not as yet been isolated*. It is very likely communicated from one person to another through the secretions transferred on towels, handkerchiefs, etc., especially among those who live in crowded tenement houses or in dwellings where the ordinary laws of hygiene are not observed. *It is essentially a dirt disease*.

*Treatment.*—In the acute variety *cold applications* should be used frequently, followed by the instillation into the conjunctival sac of a solution of boracic acid, gr. 15 to oz. 1; solution of bichlorid of mercury 1-6000 or solution of formalin 1-4000. When the discharge is established and especially when it becomes excessive, the conjunctival surfaces of the lids should be painted with a one or two per cent. solution of nitrate of silver, the excess being washed away or neutralized with a solution of common salt. A twenty per cent. solution of protargol or argyrol may also be used with benefit.

In the early stages frequent irrigation of the conjunctival sac with mild antiseptic solutions should be resorted to. When the *granulations are prominent* they should be removed by expression, either by means of the thumb nail or, better still, using one of the *several forceps* devised for the purpose; the roller forceps of Knapp, for example. The lid is everted and one arm of the forceps passed well into the cul-de-sac; the everted lid is then grasped and the forceps drawn away, the granulations being thus squeezed out. Another portion is then treated and the procedure repeated until all visible nodules are removed. As the operation is quite painful a general anesthetic should commonly be given. The conjunctival sac should then be irrigated with some mild detergent solution. Considerable reaction follows but soon subsides under the frequent application of iced cloths. If there is much discharge nitrate of silver or argyrol solution should be applied to the lids one a day or every second day. After this subsides astringents should be used, either as solution or, better still, in the solid form. The best of these is the so-called *lapis divinus* (q. v.) gently applied to the everted lids every other day, any excess of the remedy being washed away. An ointment containing

℞	
Cupri sulph.	gr. x
Vaselin	℥i
Or,	
℞	
Tannin	gr. x
Vaselin	℥i

may be given to the patient to apply between the lids once or twice a day. *Dusting the lids with tannic acid* has proved useful in some cases.

*Frequent cleansing of the conjunctiva* with non-irritating antiseptic solutions should also be carried out by the patient at home. One of the best of these is a 1-5000 solution of formalin.

In the early stages, when the granulations are excessive and prominent, massage of the lids with the yellow oxide of mercury ointment:

℞

Hydrarg. oxid. flav. gr. v,

Lanolin.

Vaselin. āā ʒss,

or the *nitrate of mercury ointment made up with brown ointment*, (q. v.) diluted to the proper consistency with refined cod liver oil, has given good results in producing absorption of the granulations.

The applications to the diseased lids should be kept up for a long time, many months elapsing, even in the mild cases, before the disease can be cured. Atropin should be used when corneal complications set in. The management of these will be considered later on.

For the *treatment of pannus*, especially when it has a tendency to spread over the whole cornea, excision of a strip of the conjunctiva (*peritomy*) surrounding the cornea is effective, to destroy the blood vessels which supply it. This procedure has proved of benefit in most cases, although it cannot always be relied upon to eradicate the process.

*Excision of the entire fornix of the conjunctiva* has been successful in many cases in checking the disease but it should be resorted to only when the disease is far advanced, i. e., in the stage of cicatrization.

M. K. Foster, (p. c.) believes that the *use of bluestone* in trachoma is efficient or not, according to the way it is applied. He has been successful in bad cases of trachoma by the use of bluestone preceded by the instillation of adrenalin solution, followed by collyria of glycerole of tannin applied by the patient two or three times a day. The pressure with which the copper sulphate is applied should vary with the severity of the disease. Light applications in bad cases merely irritate. Harm usually results from the efforts of patients to treat themselves or to be treated by members of their families when the bluestone pencil is used. If properly applied it still remains the most efficient and humane form of local treatment, operative measures being excluded.

The *Bulletin Générale de Thérapeutique* gives the following formula for making modified copper sulphate pencils for trachoma and other forms of granular lids:

℞

Cupri sulph. pulv. 10.00

Orthoform. 5.00

Holocain. hydrochlor.

Tragacanth āā 4.00

Aquæ dest. q. s.

Mix thoroughly and roll into pencils of convenient size. Although

they contain 50 per cent. of copper sulphate they cause no pain when applied to the granular surface.

T. A. Woodruff,\* who has made a study of *recent trachoma*, favors in the *early stages the local application of copper sulphate solution*. He thinks the solid stick is preferable in the later stages when the trachomatous bodies have invaded the deeper tissues and an escharotic effect is desired. The solution should be as strong as can be comfortably borne by the patient and without setting up too severe a reaction. It should be brought in contact with all portions of the diseased area and applied well into the culs-de-sac by means of cotton twisted around a tooth-pick after complete exposure and thorough drying of the conjunctival surfaces with a pledge of cotton or sterilized gauze. This procedure may be repeated as often as is considered desirable, care being taken to dry the conjunctiva before each application. He uses a *saturated solution of sulphate of copper in glycerin (90 grains to the ounce)*, and from this makes a fresh solution with water each day by the addition of fifteen drops of distilled water to one drop of this glyceride of copper. The strength is gradually increased until the point of toleration is reached.

If this treatment is carried out daily or every other day, much can be accomplished in the absorption of the granulations and in cutting short the disease. Alternating with the copper solution is massage with an ointment made up of nitrate of mercury and cod-liver oil (see *Brown Ointment*). A small quantity of this is placed on the upper part of the globe beneath the upper lid and then distributed over the anterior surface of the eyeball by having the patient rotate the globe in various directions. The upper lid is then gently massaged with the finger for one to three minutes, the patient meanwhile turning the eyeball well downward. The lower lid should be treated in a similar manner while the globe is rotated upward. If the granulations persist, direct massage of the exposed conjunctiva may be practised; powdered boric acid is dusted over the surface of the everted lid and well rubbed over the granulations, even to the point of bleeding, with the ball of the finger. This can be done with very little pain or discomfort to the patient, and acts very effectually in the absorption of the granulations. *If the disease becomes acute and discharge is present, nitrate of silver should be used in a solution of from 1 to 2 per cent.*, thoroughly painted on the palpebral conjunctiva and well into the culs-de-sac, in a manner similar to the method of applying the copper solution. This should be followed by irrigation of the conjunctival sac with a physiologic salt solution for the purpose of washing away any excess of silver.

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\*A. M. A. Meeting, 1907.

The patient should be removed from all unhealthy surroundings and placed where he will receive an abundance of fresh, pure air. His sleeping apartment should be well ventilated and the general health improved when it is defective, and all near work should be prohibited. Any existing errors of refraction should be corrected. The eyes should be protected from all irritating influences, such as bright light, wind, dust and smoke, by the wearing of protective glasses. These may be tinted or not depending on the photophobia present, and the rim should fit closely to the neighboring parts, so as to preclude the admittance of irritating material into the eyes.

As routine treatment of *subacute cases* cold water applied to the lids, every two or three hours, and the frequent cleansing by irrigation of the conjunctival sac with non-irritating antiseptic solutions, such as boric acid or bichlorid of mercury 1-10,000, should be carried out by the patient at home; one of the best of these is a 1-5,000 solution of formalin. Every particle of secretion should be removed by gently washing it away. When discharge is present the use of a solution of argyrol, from 10 to 20 per cent., instilled into the eye two or three times a day will prove beneficial. A 10 per cent. ointment of citrate of copper has been highly recommended for use by the patient at home. It is well to remember that trachoma is a chronic disease from its onset, and displays a stubborn resistance to the many remedies and procedures used for its relief. It is only by persistently keeping up treatment and varying it from time to time as the case demands that we can hope to arrest the progress of the disease and prevent those disastrous sequelæ which, invading the eyeball and deeper structures of the lid, result in lifelong suffering.

As S. J. Bumstead (p. c.) remarks, many oculists are compelled to treat this affection in people who must continue at their work as if nothing were the matter with them. It often happens too that they or some member of the family must administer the remedies prescribed, while the surgeon sees them only at rare intervals. In such cases he believes nothing acts as well as the *application to the conjunctiva by the patient or friend, of iodine crystals in glycerine, beginning with one grain to the ounce*. After a time the dose can be increased to two or three grains to the ounce. The sensitiveness of these cases varies so much that it will always be best to begin with the one grain solution. A little potassium iodide facilitates the solution of the iodine. He has also used it in liquid petrolatum and believes this is best in some cases.

*Operations for the relief of the various forms and some of the complications of trachoma.* de Schweinitz (*Text-book*, p. 288) men-

tions: *Scarification of the conjunctiva; abscission of the granulations; excision of the retrotarsal fold with or without a strip of infiltrated fornix; excision of the tarsus (Kuhnt), and squeezing or rolling out the trachoma follicles* with Noyes', Knapp's or Kuhnt's forceps.

A. F. MacCallan (*The Ophthalmoscope*, Nov., 1908) has had an extensive experience of trachoma in Egypt and prefers Kuhnt's *combined excision of tarsus and conjunctiva* as the best radical measure he is acquainted with. With much more limited opportunities (although I have done some 52 extirpations to date, beginning the work in 1898\*), I can render similar testimony to its great value in relieving all the symptoms of the cicatricial stage—pannus, entropion, trichiasis, etc.—in cases not relieved by other treatment. I have reserved this operative procedure for the late manifestations of the disease and, in agreement with MacCallan, think that the “suitable cases are those in which there is considerable thickening [and involvement of the tarsus] of the lid and no granulations in the fornix.”

For those who refuse *grattage, brossage*, or other operative measures Homer E. Smith (p. c.) employs a 10 per cent. solution of *copper sulphate in glyccrinc*, as follows. One drop of the strong solution is added to 10 drops of water and of this dilution one drop is instilled into the eye three times daily. The strength of the diluted mixture is gradually increased until it reaches 1 in 4.

E. F. Kammerly, Jr. (p. c.) has also had considerable experience in Blockley Hospital and elsewhere of the application of *sulphate of copper in glycerine*. He prescribes a 10 per cent solution and directs the patient to mix one drop with 15 of water, putting 1 drop of this mixture into the eye four times daily. The diluted mixture is made fresh at each application. Of course he uses this collyrium as an adjunct to expression and other forms of treatment.

When *lunar caustic or copper sulphate pencils* are contraindicated, Schiele employs the *solid stick of iodic acid* and claims that it does not produce scarring.

Edward P. Brever (p. c.) everts the lid and applies with a brush to the granular surface a 10 per cent. aqueous solution of *ichthyol*. This is followed by rubbing the exposed mucous membrane with the tip of the finger. The ichthyol is daily alternated with applications of freshly prepared 20 per cent. argyrol.

J. A. Pratt reported in the *Ophthalmic Record* for 1905 his use of *boric acid massage* for the treatment of this disease. The finely

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\*Casey Wood, *Annals of Ophthalmology*, p. 372, 1898, and the *American Journal of Ophthalmology*, July, 1903.



trituated powder is dusted over the everted lid which is then massaged in the usual way upon the eye-ball.

Masselon (34) reminds us that *jequirity* (q. v.) should be used only in those cases where granulations are unaccompanied by marked secretion; that it should never be applied where there is suppuration. It is especially indicated in old trachoma with pannus and sclerosis of the cornea; it should be *thoroughly pulverized* and applied to the conjunctiva with a camel-hair brush, the lids being everted so that the cornea is protected. The powder is allowed to remain in contact with the lids two to five minutes, and is then brushed off. If the reaction is not marked, this application should be repeated next day. The subsequent inflammation should be treated by cold applications and mild antiseptic washes.

Klein (51) reports the successful employment in the *postoperative treatment of trachoma granulations of one part of calomel thoroughly incorporated with five parts of powdered cane sugar* (q. v.). The mixture is dusted on the everted lids as usual.

The use of *jequirity* (q. v.), either in powder or infusion, for the treatment of *pannus* has unfortunately fallen into abeyance in America, mainly because of the variable dosage and its dangerous and uncertain action. Römer (23) has sought to remedy these defects in an otherwise valuable agent by the careful manufacture, from the *Abrus precatorius* of a *definite compound containing 50 per cent. glycerine* which he has called *jequiritol*. He believes this to be a more reliable preparation than abrin (q. v.), the infusion or the powdered seeds. It is made in four different strengths. The treatment begins by the instillation of a single drop of No. 1 on the first day, the dose being gradually increased in amount and strength until a well-marked jequirity inflammation is set up. Should the inflammatory reaction at any time be too severe it is controlled by dropping into the eye a small quantity of jequiritol serum (prepared on the principle of Behring's serum) repeated as often as necessary or, if the reaction be excessive, by its hypodermic use. Both remedies are prepared and sold in a box—with full directions for use—by Merck & Co. I have had considerable experience with this remedy and *recommend its use to my colleagues in pannus trachomatous* especially.

Cheatham was the first in this country to recommend the application of *powdered jequirity* (q. v.) directly to the conjunctiva. Employed with due caution, this is a very successful method of treating trachomatous pannus and is not as dangerous as it seems to be.

J. D. Seba (p. c.) has had much experience with and prefers the *freshly prepared infusion of the powdered bean*. He begins with



swabbing or flushing the everted conjunctiva with a mixture of a quarter of a grain to a drachm of distilled water. As soon as the jequirity conjunctivitis sets in the patient uses a simple borated wash every three or four hours. When the inflammation subsides he again applies the jequirity, increasing the strength of the mixture as much as is necessary to set up a decided conjunctivitis.

In old cases of trachoma G. C. Savage (p. c.) has had marked results from the use of a *weak infusion made from the powder of half a bean*, mixed in a fluid ounce of distilled water. To this infusion he often adds 20 grains of boracic acid. Into each of the diseased eyes two drops are put at bed-time and the action of the drug carefully watched. A fresh infusion should be made every two weeks and the use of the remedy continued until recovery is complete.

J. G. Dorsey, (p. c.) employs the following mixture:

R

Zinc. sulph.

Ferri sulph.

Cupri sulph.

Aluminis āā

ʒiii

Liquor. potassii arsen.

Tinct. iodi fortior. āā

gtt. xxx

Aquæ dest. ad

ʒiv

Filter and use as follows: Put one drop of the above mixture into a fluid ounce of distilled water and apply to the everted eye-lids, especially to the fornix, with a cotton applicator twice daily. Increase the strength of the mixture each day until tolerance is reached.

As a result of six years' experience as ophthalmic surgeon to the Arkansas State School for the Blind, with from 75 to 150 cases of trachoma constantly under treatment, C. C. Stephenson (p. c.) prefers the application of a 1:15 *mixture of tannin in boroglycerine*. This should be rubbed on the everted lids once daily with a cotton applicator, with sufficient force to produce a slight hemorrhage from the conjunctiva. The burning from this mixture does not persist as long as that from copper sulphate, and accomplishes more.

W. B. Anderson (p. c.) prefers the *oxy-chloride of copper by electrolysis or cataphoresis*. He has found this agent acts more satisfactorily than any other copper salt. The technique is as follows:

Apply to the everted lid, which has been previously cocainized, a copper eye electrode attached to the positive pole of a galvanic battery, using about 3½ milliamperes of current about five or ten minutes. He says *about* advisedly, because some patients are more sensitive to this agent than others. Instead of using a milliampere-

meter he permits the patient to regulate the current by the amount of pressure with which the negative sponge electrode is applied. Experience has taught him that better results are had by brightening the eye electrode before each application. This application is repeated every five days. By this method one does not have the destruction of epithelium that is sustained when copper sulphate stick is used. Moreover, the *cataphoretic* copper, which is almost as powerful a germicide as bichloride of mercury, penetrates the deeper structures of the lid and reaches every follicle. So efficacious is this measure that the incurable cases are practically nil. He has found it especially useful in non-inflammatory cases of long standing in which the trachoma follicles are disseminated through the stroma, more especially if these follicles are transparent and accompanied by a mucoid secretion, and are in patients of lymphatic temperament. In such instances no other treatment has in any way compared with this in his hands.

D. S. Sager (p. c.) believes that in *trachomatous* and *chronic granular conditions of the conjunctiva*, the *cataphoretic treatment of the lids* should be given a fair trial. He has succeeded with it when radium, X-ray, Finsen light or high frequency currents, have failed. The method is accomplished by placing the positive end of a copper electrode in a solution of common salt, the negative electrode also in the solution, with no contact of electrodes. When a sufficient amount of copper chloride is deposited upon the positive electrode the latter, after wiping the lid clean with absorbent cotton, is applied directly to the lid-surface for a few seconds to half a minute. Sometimes the lid is cocainized or rendered insensible by holocaine or eucaine. The reaction is considerably less than with copper sulphate stick but this will depend somewhat upon the individual.

J. Whitefield Smith (p. c.) has found the following of great value in the treatment of trachoma *after the active symptoms have subsided*:

R	
Acid. carbolic.	gtt i
Acid. tannic.	gr. x
Glycerini	fl. ʒi

One drop to be put into the eye morning and evening.

F. C. Todd and John S. Macnie (p. c.) believe that *ichthyol ointment* and the *glycerine solution of copper sulphate* form, on the whole, the most satisfactory treatment of both the acute and the chronic form of the disease. The patient is given a dram of 10 per cent. glycerine solution with instructions to use one drop of it in 20 drops of water and to instill one or two drops into the eyes three or four times a day

until this watery solution is exhausted and then make a fresh one. They prepare the following ichthyol mixture:

R

Ichthyol. gr. iv

Petrolati

Lanolin. āā 5ss

Recently (*Med. Presse*, Feb. 26, 1908) Goldzieher has revived that old remedy, the *inoculation of the conjunctiva with gonorrheal pus* in the treatment of *pannus crassus*, first used by Jaeger. He prefers it to jequirity and believes the resulting infection to be no more dangerous than *abrus conjunctivitis*. He finds the external ocular tissues in better condition after the subsidence of the infective conjunctivitis than when jequirity is used.

H. A. Kiefer (p. c.) on account of the extremely *contagious character of trachoma*, making it possible for the patient to reinfect himself from the various objects with which he comes in daily contact, thus undoing the work that the surgeon has accomplished by operations and other forms of treatment, has made it a practice for the past seven or eight years to *thoroughly fumigate all the patient's belongings*. This includes his wearing apparel, bed-clothes and especially the pillows, and all other things that pertain to his wardrobe and apartments and the room he occupies in sleeping. The fumigation is accomplished just before or after operation, or while he is in the hospital. If it is not a surgical case it is done just as soon as possible. The fumigation should be repeated at each operation, and at other times subsequently. In non-operative cases he has the fumigation repeated every few weeks while the case is under his care, just as in operative cases.

*Copper citrate* is a valuable substitute (generally employed as a 5 per cent. solution) for bluestone in the treatment of trachoma and allied diseases. von Arlt (22) also uses it in place of silver nitrate in the form of a 5 to 10 per cent. salve made with glycerin and starch. He applies this mixture (which the patient can easily continue at home) two or three times daily on the end of a glass rod and rubs it into the conjunctival sac. The lids are then closed and massage is employed for about half a minute. The pain is slight and transient. He refers to three cases of pannus in which the trouble disappeared in from 7 to 12 days.

One or more of the various radiations from *radium and its salts* have been used with considerable success in *trachoma*. Beck (3) says that the radiations from not less than 50 milligrams of 10,000 radioactivity should be employed and that, as a rule, the greater the activity

of the remedial agent the better the results. The salts of the element are thought to be equally active as the metal itself. Birch-Hirschfeld, Fanta and others report cases of severe trachoma treated with radium in a glass tube. The trachoma bodies as well as the surrounding infiltration rapidly disappeared. In all probability this remedy will eventually be found to furnish radiations of the same therapeutic quality as the X-rays.

I. H. Egbert (*N. Y. Med. Jour.*, March 21, 1908), deprecates the employment of the most common agent in the treatment of this disease—sulphate of copper. He alludes to the use of 1:500 solution of bichloride of mercury rubbed into the conjunctiva (formerly practised in Egypt by Kenneth Scott) as more or less satisfactory, but he believes that the manipulation and not the medication is the important factor in the procedure, since he has obtained good results from *massage of the lids with a smooth glass spatula alone*.

Previous to this treatment he opens and empties all granules and removes hyperplastic material with a sharp and blunt curette so constructed that all portions of the conjunctiva can be reached with little danger of injuring smooth, healthy tissue. When done thoroughly the operation will seldom require repetition, though stimulation through rubbing with the blunt instrument is frequently called for at intervals to promote resolution in the diseased area. This rubbing and massage may often, however, be advantageously carried out by means of the glass spatula just mentioned.

I am indebted to S. Rush Weaver for the formulæ of the following collyrium, used extensively throughout Texas for the treatment of trachoma in all its forms but especially after expression, grattage or other operative procedure. The active agent is evidently the *iodide of silver* (q. v.), made by the action of potassic iodide on the argentic salt.

(Formula A.)

℞	
Argent. nitratis.	ʒii
Glycerin.	fl. ʒss
Aquæ dest.	fl. ʒii

(Formula B.)

℞	
Pot. iodid.	ʒss
Glycerin.	fl. ʒi
Aquæ dest.	fl. ʒss

Mix thoroughly three drops of formula A with six drops of

formula B. Instill three or four drops of the mixture on the everted lids every morning. Use separate pipettes for making the mixture and putting it into the eye.

In the chronic forms of the disease J. Hazlewood (p. c.) uses the following:

R

Acid. tannic.	gr. ii,
Tr. iodini	m. v-x,
Sol. adrenalin. 1:1000	f. $\text{ʒ}$ iv,
Aquæ dest. ad	f. $\text{ʒ}$ i.

Three drops into each eye three times a day. The mixture keeps well and causes little pain.

## CHAPTER XXXVI.

### TREATMENT OF DISEASES OF THE CONJUNCTIVA—CONTINUED.

*Morax-Axenfeld Conjunctivitis—Follicular Conjunctivitis—Purulent Ophthalmia — Non-Gonococcal Purulent Conjunctivitis — Gonorrheal Ophthalmia in the Adult—Ophthalmia Neonatorum—Prophylaxis and Treatment—Blennorrhœa Neonatorum from the Bacillus Coli Communis and Other Non-Gonococcal Bacteria.*

#### *Morax-Axenfeld Conjunctivitis.*

*Angular conjunctivitis. Diplobacillus conjunctivitis. Subacute. catarrhal conjunctivitis.*

In this infection of the conjunctiva, due to the *presence of the Morax-Axenfeld bacillus*, the discharge is slight though mucopurulent and characterized by a vascular edema of the conjunctiva opposite the inter-palpebral aperture. In addition to the ordinary applications proper to hyperemia of the conjunctiva, the effect of the soluble zinc salts is almost specific. Harold Gifford, among the first to make a study of this disease, advises *zinc chloride 1/5 of one per cent.*, while others prefer the *sulphate in form 1/4 to 2 per cent. solution* two or three times daily.

F. C. Todd, and John S. Macnie (p. c.) prescribe the following mixture, to be applied to the conjunctiva, in infection by the Morax-Axenfeld bacillus, with cotton pledgets or to be dropped into the eye three times a day:

℞	
Zinci sozoiodolat.	gr. iii-viii.
Chloreton.	gr. i
Aquæ dest.	fl. ʒ i

In treating *diplobacillus conjunctivitis* R. L. Randolph (p. c.) never uses a stronger solution of the zinc sulphate than one grain to the ounce of water and it is usually associated with fifteen grains of boracic acid. (See *Zinc borate*). Often he uses half a grain with first-rate results in the same form of conjunctivitis.

C. T. Cadwell (p. c.) has seen the best results follow the application to the conjunctival sac and the palpebral skin of the following prescription:

℞	
Ammonii. ichthyol.	o.15

Zinc. oxid.	5.00
Vaselin. alb.	15.00

To be thoroughly mixed.

A. D. McConachie (p. c.) prefers the following prescription:

R

Zinc. chlorid.	0.015-0.030
Sol. sodii. chlor. (0.9 per cent.)	30.00

Two or three drops to be put in the eye three or four times daily.

E. V. L. Brown (p. c.) believes that many examples of *squamous*, *marginal blepharitis* are in reality due to the Morax-Axenfeld bacillus, that scrapings from the bases of the lashes show the organism, and that zinc ointment in almost any shape is practically a specific. Yellow oxide of mercury, to which we are so accustomed, has no effect on these cases.

### Follicular Conjunctivitis.

*Simple granular lids. Granular conjunctivitis. Follicular ophthalmia.*

This disease is with some difficulty, especially in the early stages, differentiated from trachoma but it has little in common with it except the *enlargement of the conjunctival follicles*. It may be regarded as a simple conjunctivitis *plus* non-trachomatous folliculitis. The *symptoms* and *prognosis* are those of simple, catarrhal conjunctivitis.

*Treatment* consists in relieving the symptoms by the application of *cold compresses followed by a mild antiseptic lotion* such as a saturated solution of boric acid, much the same as described under catarrhal conjunctivitis. A soothing and efficient lotion in such cases, to be instilled after the use of cold applications, is:

R

Acid. hydrocyanic. dil.	gtt. i,
Acid. boric.	ʒss,
Sodii boratis	ʒ ii,
Aquæ dest.	f. ʒii.

The patient should be *removed from all unhealthy surroundings* and placed where he will receive plenty of fresh air. The general health should be improved when it is defective and, if necessary, all near work prohibited. Any existing error of refraction should be corrected. As adjuncts to this treatment many remedies have been recommended by different authorities, showing that they all are of some service. An ointment of sulphate of copper in vaselin (one per cent.) applied to the lower conjunctival sac once a day has proved useful in many cases.



A method of treatment which will prove satisfactory in the majority of instances and which is much less irritating is *massage* (q. v.) *of the lid with the ordinary dilute citrine ointment, made with* unrefined or brown cod liver oil instead of with the usual excipient, and this again diluted with from 30 to 50 per cent. of refined cod liver oil. (See *Brown ointment*.) A small quantity of this salve should be placed in the lower cul-de-sac and then distributed over the anterior surface of the eyeball by having the patient rotate the globe in various directions. The upper lid is then gently massaged with the finger for from one to three minutes, the patient, meantime, turning the eyeball well downward. The lower lid should be treated in a similar manner while the globe is rotated upward. This procedure should be carried out at least every other day at the beginning of the treatment, increasing the interval as improvement is noted. The surplus ointment (which is of a dark brown color) should not be washed off the lashes and lid edges for an hour or two after the rubbing because its local, mildly corrective action seems to be of value in these cases.

Stephenson advises, when the cornea is not involved, the use of a *one per cent. ointment* of the subacetate of lead. A small piece is applied to the everted conjunctiva once a day. After two weeks' time the strength of the ointment is doubled, the application being followed by massage. Under this treatment the hyperemia disappears, the discharge is less, the follicles become reduced in size and eventually disappear.

Iodol is also used in *follicular conjunctivitis*, a salve being made up as follows:

℞	
Iodol.	2.00 (gr. xxx),
Petrolati	
Lanolin.	āā 5.00 (ʒi gr. xv.),
Ol, rosæ	gtti.

A. Duane (p. c.) uses the following favorite prescription suggested to him by H. Knapp:

℞	
Cupri. sulph.	0.01
Vaselin. alb.	10.00

E. M. Alger (p. c.) applies thoroughly *to the everted lid* once a day and with a cotton swab the following:

℞	
Tinct. iodi.	
Glycerin	āā fl. ʒi

**PURULENT OPHTHALMIA AND ITS TREATMENT.****Purulent or Gonorrheal Conjunctivitis.**

*Ophthalmia neonatorum. Blennorrhœa neonatorum Ophthalmoblenorrhœa.*

Although these names indicate practically the same infective process yet the different periods of life in which they occur exert a decided influence upon the signs, symptoms, prognosis and treatment of the disease.

**Non-gonococcal Purulent Conjunctivitis.**

Not only may the non-specific forms of conjunctivitis be so aggravated by neglect and improper treatment that they assume a purulent form bearing the same clinical feature as gonorrheal conjunctivitis, but they may, without any evident reason, assume that form at any time. This may be the case in diphtheria, in Week's conjunctivitis, in pneumococcus conjunctivitis and even in streptococcus infections.

The treatment of such cases—identified chiefly by smears and cultures—is frequently cleansing by *borated or permanganate douches* (q. v.) the use of *argentamine* (q. v.) or mild (one per cent.) nitrate of silver application three times daily after cold compresses. Gently swabbing the everted conjunctivæ with sublimate, 1:5000, instead of the silver, is also effective.

Harman believes that the various albuminoid preparations of silver chiefly hold their sway owing to the fact that they cause less pain on application than the nitrate. To a half, one or two per cent. of silver nitrate in distilled water he accordingly adds fifteen per cent. of pure glycerine. This raises its specific gravity and greatly increases its penetrating power. It is distinctly less painful and more efficient than the ordinary solution and can be used more satisfactorily in blennorrhœa than the pure nitrate.

M. H. Bell (p. c.) believes in full doses of silver nitrate in specific and non-specific blennorrhœa *as soon as the diagnosis of a serious infection is made*. Instead of waiting, as some advise, until the purulent discharge has set in he *uses it from the very commencement* on the supposition that the action of the antiseptic is mainly directed as a germicide against the bacterial invasion and before the bacteria have penetrated deeply into the mucous membrane. He has followed this rule in 15 or 20 cases and has not so far noticed a corneal involvement.

R. L. Randolph (p. c.) *places no confidence in any of the silver salts except the nitrate when it comes to gonorrheal infection of the conjunctiva*. He has always held that it is a great risk to experiment with the other salts. He believes that much of the success that he has met with in treating this serious condition is due to freely "open-

ing up" or scarifying the conjunctiva, particularly near the corneal border, treating the area just as one would an infected area elsewhere in the body. *The free bleeding always betters the condition.*

Kalt, who has had considerable experience in the treatment of *infective conjunctivitis and keratitis with large quantities* of irrigating fluids, is much in favor of *calcium permanganate* (q. v.), which he has found very effective and non-irritating. He advises half a gramme of the salt to 1½ litres of warm, sterile water, the whole amount to be used one, two, three or four times daily. One or two additional flushings with warm sterile water may be used in the interval.

John S. Kirkendall (p. c.) much prefers strong solutions of silver nitrate and generally uses *forty grains to the ounce of distilled water as a single application* in all cases of gonorrhea of the conjunctiva, both infantile and adult. Since the adoption of this plan 15 years ago he has never lost an eye or had a scar of the cornea, although previously both of these accidents occurred. He *everts both lids and applies the silver solution thoroughly to the exposed mucosa*, afterwards washing it off with a strong salt solution. This is followed by the use of argyrol every hour, cold applications and thorough cleanliness. He is rarely obliged to use the strong silver solution a second time and has never seen an instance of chemosis of the conjunctiva or corneal implication of any kind, following its application.

Adam has recently read a paper before the *Ophthalmologische Gesellschaft* in which he recommends the use, as a *salve*, of *lenicet* (q. v.) *combined with euraseline* (q. v.). He has found that under these applications the excessive secretion shortly decreases in amount, the number of bacteria is lessened and that the whole treatment is much more satisfactory than the classic methods commonly in vogue. Of 24 cases treated by the lenicet ointment in five only was the cornea at all affected. The salve, which goes by the name of Bleno-Lenicet Ointment, is applied every two hours and is used in from 20 to 50 per cent. strengths.

#### **Gonorrheal Ophthalmia in the Adult.**

Like *gonococcal ophthalmia neonatorum*, this is due to direct infection of the conjunctiva by the discharge from a gonorrhea or gleet. It is conveyed to the eye by means of the fingers, towels, etc. *The gonococcus is usually present in the discharge*, which should always be carefully examined in suspected cases. In from one to three days after infection the lids become red and swollen, and the inflammation is accompanied by a watery discharge. The conjunctiva is red and turgid. The swelling rapidly increases, the lids become puffed, tense and hard, are with difficulty separated and cannot be everted, and the upper lid overrides the lower

lid. The conjunctiva is of a dusky red color and soon becomes chemotic (edema), concealing the corneal margins and interfering with their nutrition. Pain is present from pressure of the swollen lids, and there is smarting and burning of the lids and a feeling of foreign body in the eye. The discharge quickly becomes thick, purulent and tinged with blood. It wells up and runs over the margin of the lid on to the cheek. *The conjunctiva is thickened and thrown into folds, and in some cases is covered with a thick, tenacious membrane, diphtheritic in character, which leaves a bleeding surface when removed.* In a week or ten days these symptoms somewhat subside. The turgescence and tumefactions of the lids are less, and they become softer, the discharge less abundant. The pain is not now so marked, while the chemosis of the conjunctiva decreases, the membrane, however, presenting a velvety appearance, owing to the hypertrophy of the papillæ, which bleed on the slightest touch. As the inflammation becomes less the swelling also goes down, leaving the conjunctiva of the lids roughened and covered with granulations. The secretion becomes thinner and gradually disappears, although the state of hyperemia remains.

During the stage of marked swelling and edema of the conjunctiva the vitality of the cornea is interfered with; it may become dull and lusterless, while corneal ulceration is liable to occur, terminating in its total destruction. In this case perforation usually takes place and the eye may eventually be lost from a panophthalmitis. On the other hand, a cicatrix may form at the point of perforation and a partial or total staphyloma of the cornea result.

*The prognosis of gonorrheal ophthalmia is extremely grave; the symptoms follow one another rapidly, while vision is often impaired to a greater or less degree.*

*Treatment.*—The sound eye should be at once protected by means of a Buller's shield. Iced applications should be applied almost continuously in the manner described in the treatment of ophthalmia neonatorum (q. v.). The conjunctival sac should be carefully irrigated every half hour with a saturated solution of boracic acid, *permanganate of potassium* 1-5000, bichlorid of mercury, 1-10,000 or sol. formalin 1-5,000. The irrigant should be allowed to run well up into the conjunctival sac and all discharge washed away. As soon as the lids become less swollen and less tense and the secretion more profuse and purulent, local applications of nitrate of silver, 2 per cent., should be made once a day. If possible, before the use of the silver salt, all discharge must be removed and the everted conjunctival surface wiped dry with absorbent cotton.

As noted in the treatment of ophthalmia neonatorum the applica-

tion in this disease of agents directly to the eye, such as the use of pledgets of cotton in cleansing, is so often attended by danger from slight traumatism and subsequent infection that the practitioner should be the only one to evert the lids, make application to them, or to use instruments of any kind about the inflamed eye. If he is not expert in these matters, it will be wiser for him not to attempt direct medication at all, as he may do more harm than the applications will do good.

Protargol, argyrol, 20 to 40 per cent., or full doses of sophol, argentamine, or any other of the organic silver salts (q. v.), applied for 15 minutes to half an hour, as Myles Standish directs, by means of a dam of clay, or other material, directly to the parts, may be used in place of the silver nitrate. If the cornea becomes affected, hot should replace cold applications, while a 1 per cent. solution of atropia sulphate should be instilled into the eye two or three times a day, or sufficiently often to control the pupil.

*Hydrogen peroxide* (q. v.) may also be used with advantage as a pus destroyer and cleanser. Where there is excessive edema of the conjunctiva scarification may be resorted to. Freely dividing the outer canthus will be of benefit in relieving the pressure on the cornea of the tense, swollen lids.

Numerous instruments have been devised for the purpose of irrigation and as a means of injecting solutions into the upper conjunctival sac, but *unless used with great care they may injure the cornea and set up ulceration*. Amongst these is the hollow lid retractor, which has openings in the blade through which the solution escapes.

All dressings, absorbent cotton, etc., which come in contact with the eye should be burned, and great care must be exercised by the surgeon and nurse that none of the secretion squirts into their own eyes when an attempt is made to separate the lids. Their hands should be washed and scrubbed in an antiseptic fluid, such as corrosive sublimate 1-10,000, immediately after attending to the eye.

The bowels should be kept open and morphia given hypodermically if much pain is complained of.

Gifford (p. c.), in serious cases where there is much swelling of the ocular conjunctiva does not hesitate to *cut away any of the palpebral mucosa that overrides the cornea* so that the latter can be seen and all retained discharges removed. In most instances, also, he brushes the everted lids twice a day with a 2 per cent. solution of zinc chloride instead of silver nitrate and believes he obtains better results therefrom.

As a result of a wide hospital experience in this disease M. D.

Haspel, (p. c.) prefers to all other methods the *continuous treatment with argyrol*. During the first three days he instills every 15 minutes a 20 per cent. solution. This is followed by a 10 per cent. solution every half hour for 24 hours and then every hour the next day, every three hours the subsequent day and, as a rule, on the 10th day the patient is discharged. When this persistent treatment could be carried out the second eye was not affected.

Francis Valk (p. c.) in addition to thorough cleansing of the eye makes use of a nitrate of *silver solution prepared in the following way*: Dissolve five grains of pure crystals of nitrate of silver in six drachms of distilled water and then add two drachms of sweet spirits of nitre. This solution will keep much better than the usual solutions as it does not tend to precipitate the oxide. He thinks the free nitrous acid in the sweet spirits of nitre keeps the silver in a nascent solution, and in this way, he believes we get a much better effect than from the usual solution, even when used in much stronger proportions. Furthermore, this solution does not need or require neutralization with the salt solution as he has never noticed any untoward effects from its very free use in the eyes of young children.

De Falco has revived the old plan of using a *solution of salicylic acid instead of strong doses of silver nitrate in gonococcus ophthalmia*, As an eye wash every few minutes he uses a solution of salicylic acid (3:1000), besides permanent cold or iced compresses. A weak solution of nitrate of silver (1:6000) every three hours has an elective action on the gonococci, is very useful and does not affect the lining epithelium. If chemosis of the conjunctiva takes place and the pathogenic germs cannot be easily removed from the folds sub-conjunctival injections of sublimate (1:2000) are advised. The sublimate extracts through its deoxidizing property oxygen from the leucocytes and gonococci, arrests the ameboid movements of the former and reduces the activity of the latter, which are finally killed by the antiseptic action of the sublimate.

Davids (*Klin. Monatsbl. f. Augenheilk.*, Aug., 1907) gives an account of the treatment of 15 adult eyes afflicted with gonorrheal ophthalmia, by the Kalt method of *large conjunctival flushings*. In the beginning of the infection the eyes were irrigated three times daily, then twice a day until the secretion stopped, with 1:15,000 of potassic permanganate. In the interval of the larger flushings the eye was washed out with the same solution applied with an undine. At the same time the eye was covered with an iced, sublimate application. In all the cases, although the swelling of the lids and conjunctiva was quite marked the discharge decidedly decreased and in 8 to 10 days



ceased altogether. In three cases corneal affections set in but these, too, soon cleared up and no eye was lost. In the nine unilateral cases the unaffected eye was protected by a collodion dressing which proved quite effective.

Of 35 similarly infected eyes treated by other methods Davids notes that five were destroyed—a record decidedly favorable to the method of Kalt.

Howard Hansell (p. c.) uses, instead of the usual saturated boracic acid solution employed as a cleansing douche or a wash, a solution of *potassium permanganate* 1:2500.

As a germicide substitute for mercuric bichloride Percy Frieden-berg (p. c.) prefers *freshly prepared official chlorine water*, (q. v.) in the proportion of a drachm to an ounce in a pint of distilled water. It is better to begin with the weaker solution. He instills the mixture into the eye with a pipette every hour, if necessary.

A. D. McConachie (p. c.) prefers 1 per cent. silver nitrate, with 10 per cent. solution of protargol to be used at home every three or four hours. He precedes both the office and home treatment by irrigation with normal salt solution of 1:8000 of sublimate.

C. C. McCullough (p. c.) is a firm believer in the efficacy of *argyrol* to the exclusion of *silver nitrate* or any other argentic compound. He uses the first named agent up to 60 per cent. solutions and is in the habit of instilling a 1/5 of 1 per cent. solution of sulphate of eserine in all severe or threatening cases. Following this treatment he has never had a corneal complication.

Dudley S. Reynolds (p. c.) obtains uniformly satisfactory results by the following plan of treatment. He uses as a disinfectant:

R

Sodii chloridi	ʒiii
Hydrarg. bichloridi.	gr. viii
Aquæ camphoræ	
Aquæ menthæ pip.	āā Oii
Aquæ dest.	C. ss

Filter and use for irrigation every fifteen minutes day and night, until pus diminishes; gradually increasing the intervals of irrigation.

Restrict the patient's diet to fluids only.

The *complication of this disease by corneal ulcer* is a most serious matter and will require all the surgeon's skill to prevent loss of eyesight. Several ophthalmologists recommend the use of the *actual cautery* (as in spreading ulcer) and even penetration into the anterior chamber with the red-hot point. Better, however, is it to do a peri-



pheral paracentesis preceded and followed by cleansing of the parts to prevent infection.

I have never seen any good follow the use of eserine in these cases whether the ulcer is peripheral or not. Inasmuch as neither eserine nor atropine has any effect on the pupil while the anterior chamber is empty, I cannot see how eserine can be of any service in preventing anterior synechia or iris prolapse, while its stimulation of the peripheral vessels to encourage phagocytosis is of doubtful importance at this crisis.

Finely divided iodoform or some of its substitutes (see *Dusting Powders*) carefully applied with an insufflator is often of great benefit.

Another *sequel* of gonorrheal ophthalmia is a *simple chronic conjunctivitis*, the result of a hypertrophy of the mucosa due to the acute disease. It is associated with a mucoid discharge, conjunctival hyperemia, etc. The *treatment* is that of chronic catarrhal conjunctivitis (q. v.). Touching the mucous surface lightly with lapis divinus every day or two and the use of a collyrium containing four grains to the ounce of alum, after fomenting the eyes with ice-water, generally suffices to bring about a cure.

#### **Metastatic Gonorrheal Ophthalmia.**

A mild, bilateral, *catarrhal form of conjunctivitis* may set in as a consequence of gonorrheal toxemia—just as an iritis or an arthritis supervenes.

The cause of the conjunctival metastasis should have attention and the ocular sequel treated as simple catarrh of the conjunctiva.

#### **Ophthalmia Neonatorum**

An acute infectious inflammation characterized by the presence of an abundant and copious discharge of pus, usually accompanied by infiltrations of the subconjunctival tissue and distinctive lesions of the cornea.

The infection usually takes place during the passage of the child's head through the vagina, so that *the symptoms almost invariably show themselves during the first three days after birth*. If it occurs at a later period the infection is probably not gonorrheal but comes from soiled fingers, cloths, towels, sponges, etc. One eye is commonly affected one or two days before the other, although in some cases it is possible, if preventative measures are taken early enough, to prevent infection of the second eye. In the majority of cases, and especially in the severer forms, the gonococcus of Neisser is found in the discharge.

There is often a history of the mother having suffered from a

leucorrhea for some time previous to the birth of the child, or of the husband having recently had gonorrhea or gleet.

*There is a milder form, where the gonococcus is usually absent, that runs its course in from a few days to a week. In such cases the inflammation is not severe, and takes on the character of a simple, acute, catarrhal ophthalmia. The severe ophthalmia of the new-born begins with slight redness of the conjunctiva, accompanied by a small amount of discharge which accumulates in the corner of the eye. In a very short time the redness increases, and the lids are shiny and swollen—so puffed out that the upper lid falls down and covers the margin of the lower lid.*

*The palpebral skin shortly after becomes tense, hard and of a dusky red color, so that it is almost impossible to evert either lid. The conjunctiva is very red and much swollen, presenting a velvety appearance from the enlargement of the papillæ. This congestion rapidly extends to the ocular conjunctiva, which becomes intensely red and edematous (chemosis), overlapping the margin of the cornea so that the latter appears at the bottom of a pit surrounded by a hard rim of infiltrated and chemotic tissue.*

*The discharge, at first slight and yellowish in color, is soon very profuse, and of a cream-like consistency. It is secreted rapidly, accumulates in the cul-de-sac and flows from between the lids onto the cheek. In consequence of hemorrhages from the ruptured capillaries the discharge may assume at this stage a yellowish-green color from admixture with blood.*

*Sometimes a false membrane appears on the conjunctival surface which adheres closely to and is with difficulty stripped from the roughened conjunctiva. Occasionally this removal is followed by bleeding. As the disease progresses the lids are less tense and hard, and much of the swelling subsides.*

*The conjunctival surfaces of the lids remain thick and continue to be covered with granulations, while the ocular conjunctiva is thrown into folds. The discharge finally becomes thinner and less copious, although it is now frequently tinged with blood. The disease usually runs its course in about six weeks. The chief danger is to the eyesight. It is greatly to be feared that the disease may affect the cornea, the vitality of which is always lowered, partly by strangulation of the vascular supply induced by the intense chemosis of the conjunctiva, and partly from direct infection. When this occurs the surface of the cornea first becomes hazy, dull and lusterless; this condition is soon followed by the formation of one or more small ulcers, usually at the limbus. These spread rapidly, their course depending in a great meas-*

ure upon the resisting powers of the patient and the nature of the local infection, as shown by the amount of the chemosis, the character of the discharge, etc.

*In the milder forms* of the disease and in well-nourished babies resolution may occur with retention of good vision, even where corneal ulcer is formed, but *in the more severe infections of unhealthy infants perforation of the cornea and opening of the anterior chamber* is a common sequel. The aqueous humor gushes out, the lens and iris coming forward into the opening thus made. If the perforation occur at the periphery of the cornea, the iris alone becomes entangled in the wound. Inflammatory exudates are now thrown out and the protruding iris is bound to the cornea; the opening heals and an *anterior synechia* results with a dense white scar at the site of the iridic hernia.

The cornea itself is sometimes rendered wholly opaque, and, bulging forward under the influence of the increased intraocular pressure, constitutes an *anterior staphyloma*; or the eye may be rapidly destroyed from a panophthalmitis due to invasion of the deeper structures of the eye by the pyogenic microbes admitted through the corneal wound.

*Treatment.*—In a virulent inflammation which is followed by results so disastrous, the *prophylactic treatment* (q. v.) is of great importance. In these days of antiseptic surgery there is less danger of the child's eyes becoming infected than formerly. *When a discharge is known to exist, regular, daily cleansing of the vagina with an antiseptic solution before parturition should always be insisted upon.* After the birth of the child the lids should be wiped dry with a piece of sterilized gauze, *the eyes should be carefully opened and with a sterilized medicine dropper one drop of a two per cent. solution of nitrate of silver* should be carefully dropped into the conjunctival cul-de-sac.

This is the *method of Credé*, which, if it be carefully carried out, will greatly minimize the danger of infection. By this method Credé reduced the percentage of cases occurring in the Leipsic hospital from about 10 per cent. to 0.2 per cent. Similar results have been obtained by others, until now this preventive treatment is almost universally carried out.

Other antiseptics, including almost all those mentioned under that heading in this System, have been employed, but the silver nitrate still retains its popularity as a preventive application.

*Cleanliness* is the all important factor in the prevention as well as in the treatment of such an inflammation. Even if no vaginal discharge is present the child's eyes should be carefully looked after for some time after birth, and cleansing with sterilized water, or perhaps

better still, with a mild antiseptic solution such as a saturated solution of boracic acid, will in many instances prevent much suffering. The attention of the nurse and the attendants should be drawn to the necessity for carefully cleansing their hands, using nothing but sterile cotton or gauze when wiping the infant's lids.

When the *inflammation has actually set in*, frequent irrigation and cleansing (if the lids are hard and tense and the discharge is not profuse) of the conjunctival cul-de-sac should be carried out. A fountain syringe, undine or an Elwood irrigator should be filled with an antiseptic solution warmed to about 104° F.:

R

Acid. boric.

Sod. bicarb.

āā ʒ ii

Sol. hydrarg, bichlor (1-10,000)

f. ℥iv.

The *lids should be everted and the upper and lower cul-de-sacs thoroughly irrigated with the solution*, stopping from time to time to wipe away with pledgets of sterilized cotton any discharge adherent to the conjunctiva. This should be repeated every hour or two according to the severity of the case. Care should be taken, when irrigating, *that the nozzle of the irrigator does not touch the cornea, or that the stream does not directly irrigate the corneal surface*, on account of the danger of detaching a portion of the corneal epithelium, thus inviting infection of the cornea, the formation of an ulcer and the loss of the eye.

*The application of agents directly to the eye, such as the use of pledgets of cotton in cleansing, is so often attended by danger from slight traumatism and subsequent infection that the practitioner should be the only one to evert the lids, make application to them, or to use instruments of any kind about the inflamed eye. If he is not expert in these matters, it will be wiser for him not to attempt direct medication at all*, as he may do the child more harm than the applications will do good. This rule also holds good in the treatment of purulent ophthalmia in the adult, and is stated in quite identical terms under that heading.

If a *fountain syringe is used it should be elevated not more than three inches above the level of the child's face* (placed in a recumbent position), the nozzle of the irrigator being held about half an inch from the eye. In this way the upper and lower cul-de-sacs are gently washed out without danger of injury from too powerful a stream. The lids should be drawn with the fingers as far away from the cornea and globe as possible—first the upper and then the lower lid—and the stream directed *into* the upper and lower cul-de-sacs.

Together with the foregoing *iced applications* should be

made every hour or two for at least twenty to thirty minutes at a time. This should be done in the following manner: Take a square block of ice, perfectly flat on top and large enough to hold at least four compresses of lint each about three inches square. The latter are laid upon the swollen lids and changed often enough to keep up a uniform degree of cold. These compresses should be merely damp; it is well to squeeze out any water they may have soaked up.

The *continuous* use of cold, or the application of icebags is apt to chill the eye, to lower its vitality and to encourage the evils we most desire to avoid. An icebag is also apt to cause pain and discomfort from its weight, and its use is therefore not advisable.

As the disease advances the discharge becomes thicker and more copious, while the lids appear less glazed and tense. *Nitrate of silver* (q. v.) should now be applied once a day to the palpebral conjunctiva in from 2 to 4 per cent. solutions. First, the lids should be carefully everted, thoroughly cleansed of all adherent discharge and then thoroughly dried. The silver solution is then applied to the conjunctiva by means of cotton twisted around a toothpick, any excess of the silver salt being washed off with a 5 per cent. solution of sodium chlorid. *Care should be taken not to touch the cornea with the swab, and the greatest gentleness should always be observed by both surgeon and nurse during all the applications to and manipulations of the inflamed eyes.*

*Protargol* or *argyrol* (20 to 40 per cent.) has been recommended in place of the solution of silver nitrate. It is applied in a similar manner, is less irritating and causes less pain than the silver nitrate.

According to Merck's Reports for 1896, Zweifel pointed out years ago the advantages of *silver acetate* as compared with *silver nitrate* for the prophylactic treatment of *ophthalmia neonatorum*; this view was shared by Scripiades and Bischoff, while Leopold and Dauber held silver nitrate to be the better remedy. J. Thies held that, the two being of equal efficacy, the only possible advantage of one over the other would be due to a greater tendency of one to produce irritant appearances. To settle this matter the author made trials with 2,000 children; after mechanically cleansing the eye, he placed into the right eye a few drops of a 1 per cent. solution of silver acetate, into the left eye a few drops of the usual 2 per cent. silver nitrate solution. The eyes were then bathed with normal saline solution. He found *silver acetate to work better than silver nitrate, although the difference was not great.* It has other properties, however, which would appear to make it more suitable to the needs of practice than the nitrate. While the latter is readily soluble in water, and its solutions may gradually become more

concentrated by evaporation, silver acetate crystallizes out as soon as a concentration of 1.2:100 is reached. Thus the danger of using too concentrated a solution is entirely precluded with silver acetate. A further advantage of the acetate is said to exist in the fact that in case silver is set free from the solution the acetic acid thus liberated is less irritant than the nitric acid set free, under similar circumstances from the nitrate.

McGillivray recommends in the treatment of ophthalmia neonatorum that after the discharge has been removed by the free use of the douche and saline solution, a half-dozen drops of a 25 per cent. argyrol solution should be instilled into the eye, the chin meanwhile being held higher than the forehead. This is repeated every half hour during the day, the margins of the lids being kept smeared with vaseline during the night. If the discharge be copious, the saline douching is repeated every half hour. This method of treatment has given him admirable results, for all his cases have done well, and corneal ulceration has not been seen since he systematically adopted it three years ago.

If the treatment described be properly carried out, the discharge will speedily diminish, and recovery will be more rapid than if the lids be everted, their conjunctival surface brushed daily with a 2 per cent. solution of nitrate of silver, and mild antiseptic douchings employed at frequent intervals. In applying the argyrol (q. v.) solution it is not necessary to evert the lids, as in the case of nitrate of silver. This proceeding in the hands of the unskilled is a source of grave danger to the cornea. With argyrol all that has to be done is to remove the discharge thoroughly with the saline douche, then instil some half dozen drops of the solution into the eye.

M. H. Post (p. c.) is much in favor of the application every two, three or four hours of a solution of *alum sulphate four grains to the fluid ounce*. He believes that this adjunct to other treatment should be better known than it is and regards it as of high value in that stage of the disease that calls for an antiseptic-astringent.

Webster Fox (*Text-book*, p. 554) gives the following formula for use, twice daily, in *ophthalmia neonatorum* with marked edema of the eye-lids. Iced, cotton pledgets are to be soaked in the solution and applied to the closed lids:

℞

Zinci chlor.	0.259 (gr. iv),
Acidi borici.	0.775 (gr. xii),
Tr. belladonnæ	
Vini. opii	āā 7.39 (f. ʒij),
Aquæ camph.	
Aquæ dest.	āā 60.00 (fl. ʒii)



Gifford (p. c.) advises brushing or swabbing the everted lids in the *gonorrheal form of the ophthalmia* with a 2 per cent. solution of zinc chloride instead of silver nitrate. He exercises care not to have the solution run into the sac and believes that employed in this fashion twice a day it is superior to the silver salts as an anti-gonococcic remedy.

Should the cornea become cloudy a 1 per cent. solution of atropine sulphate should be instilled into the interpalpebral space sufficiently often to dilate the pupil. The iced compresses should be stopped and *replaced by applications of moist heat* at a temperature of 115° to 120° F. Warmed vaseline may be applied to the lid surface, previous to the application of the heat, in order to avoid scalding the skin.

These applications should be begun at a moderate temperature and the heat gradually increased. Any excess water should be wrung out of the cloths before applying in order to prevent excoriation of the skin by the hot fluid.

When the discharge becomes profuse, in addition to the silver solution the following mixture, introduced by X. C. Scott, of Cleveland, is recommended:

℞	
Hydrastin, sulph.	
Acid. boric.	
Sod. boratis.	āā gr. v,
Tr. opii deodor.	f. ʒss,
Aq. destil.	f. ʒi.

Mix and filter. To be instilled into the eye every hour.

*When the disease becomes complicated with corneal ulcer* and the discharge is excessive, *irrigation with formalin solution, 1-5,000 to 1-10,000 is also highly recommended.* It is non-irritating and a very active destroyer of pyogenic bacteria. Various other solutions have been used with more or less advantage, proving probably that the good results *are due not so much to the character of the solution as to the mechanical cleansing* that is accomplished. Among these may be mentioned:

℞	
Potass. permangan.	1.00
Aq. dest.	4000.00
Or,	
℞	
Hydrarg. bichlorid.	1.00
Aq. dest.	8000.00

*Chlorine water* is very efficient when much pus is secreted:

℞	
Aq. chlorin.	f. ʒiss
Aq. dest.	Ci.



*Peroxide of hydrogen* can also be used with advantage just before the irrigations. Following the irrigation it is good practice to insert between the lids a sterile ointment, of which petrolatum is probably the most desirable.

When pressure is obviously exerted upon the eyeball from the hard, tense and swollen lids, a canthotomy will give relief.

*The sound eye should be protected from infection*, either by a bandage or by means of Buller's shield, although in infants the former will be kept in position with difficulty.

The nurse and others in attendance upon the child must be impressed with the importance of faithfully carrying out the treatment as outlined if a favorable result is to be obtained and the eyesight preserved. They should also be warned of the highly contagious nature of the discharge.

The *general health* of the patient must be carefully looked after. The *majority of cases of ophthalmia neonatorum are recruited from the lower classes, or at least from the ranks of the improvident and careless*, and the surgeon may expect that the feeding of the infant, instruction of the mother in the management of sleep, bathing, dress, etc., will be especially required.

Sidney Stephenson in his well-known work\* on the subject comes to the following general conclusions: "In the foremost rank stands *that form of conjunctivitis, associated with the Neisser gonococcus*, an ailment usually, but by no means always, characterized by marked signs. Two-thirds of the hospital cases belong to this group, but in private practice the proportion is almost certainly less. So dangerous is this affection that, of those affected, probably one in ten loses one or both eyes, while the cornea is more or less affected in 25 per cent. of the cases. It, therefore, always calls for the prompt application of suitable remedies. A good prognosis may, in general, be given when (a) the baby is well-nourished and free from inherited diseases; (b) the case comes under care before the cornea is affected (c) and there are no local conditions, especially congenital narrowness of the fissure between the eyelids, as in premature infants, that militates against recovery. The *treatment* should consist in destroying the *gonococci locally by the use of antiseptics*, particularly by the salts of silver and in constantly removing infective discharge by the use of a non-irritating fluid. *Corneal complications* are to be opposed by physostigmine, or, if that fail, by the local application of *carbolic acid* or, especially, of the *galvano-cautery*. The last-named should probably be applied in

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\*Sidney Stephenson, *Ophthalmia Neonatorum*, London, 1907, p. 241.

every severe case. Any constitutional ailment, as syphilis, must be attended to. If the baby cannot be nursed, the question of artificial feeding should be gone into. Lastly, the contagious nature of ophthalmia should always be explained to those placed in charge of an infant suffering from the ailment."

"Then, we have *milder forms of inflammation caused by certain other micro-organisms, particularly by the pneumococcus and the colon bacillus*. For the most part, these are innocuous enough and owe their importance to their liability to be confused with the gonorrheal cases. Among them, however, are rare cases due to the Klebs-Löffler bacillus and to the streptococcus. These are dangerous and should be treated as early as possible with the proper serum."

To make a correct diagnosis is to take the first step toward scientific and successful treatment of the case. To differentiate with certainty between the various forms of ophthalmia, a bacteriological examination is imperative. The methods of investigation as a rule, are simple, and such as can be carried out by any practitioner, who is possessed of a 1-12th inch oil immersion lens and a few reagents, without any great expenditure of time. In most cases it is enough to stain films from the pus. Cultivation tests are called for only now and then."

"Repeated cleansing of the vulva, shortly before the head is born, together with careful cleansing of the skin of the eyelids as soon as the baby's head emerges is capable of materially reducing the incidence of ophthalmia. But since one can never be certain that pathogenic micro-organisms have not already reached the conjunctival sac, the employment of a germicide is always desirable, although perhaps only necessary in institutions or among the lower class of the population confined in their own houses. In good-class patients, on the other hand, the careful cleansing of the vulva and of the baby's eyelids will probably suffice, unless there is evidence that a gonorrheal infection is present or that former children of the same parents have developed ophthalmia neonatorum. Among the various chemical agents employed in the preventive treatment of ophthalmia, the preparations of silver both inorganic and organic, stand prominently forward. The 2 per cent. solution originally recommended by Credé is an efficient liquid but, unfortunately, its application to the baby's eye is often followed by so-called "silver catarrh." On the other hand, a 1 per cent. solution of the same salt is rarely complicated with consecutive reaction, and it has been shown in the course of the present communication to possess preventive powers at least equal to those of the 2 per cent. solution. It is, therefore, recommended as the best preventive agent at

present at our disposal. Sublimate, argyrol and protargol, too, are trustworthy prophylactics. The efficient prophylaxis of ophthalmia, however, implies more than the mere placing of a drop of silver nitrate or of corrosive sublimate in the baby's eyes at birth. Viewed in its wider sense, it should include the treatment of leucorrhea and of granular colpititis during pregnancy and the enforcement of the greatest cleanliness during the entire puerperium."

"It is urged that both the prevalence of ophthalmia neonatorum and its severity could be reduced by the adoption of certain other steps, of which, perhaps, the most important are: (1) the obligatory notification of the disease; (2) the instruction of medical students and of midwives; (3) the education of the public; (4) the appointment of ophthalmic surgeons to maternity hospitals; (5) the keeping and publication of records; and (6) the gratuitous distribution to practitioners of an efficient solution for prophylaxis."

"If the British Medical Association and the Ophthalmological Society could now be induced to take up the question of ophthalmia neonatorum and to move on the lines laid down in this communication—or on better ones, if such there be—we should speedily be brought to within measurable distance of realizing, as far as this country is concerned, Hermann Cohn's famous aphorism, namely: "Die Blennorrhoea neonatorum kann und muss aus allen civilisirten Staaten verschwinden."

A case of *severe purulent conjunctivitis due to the colon bacillus* is reported by Hanford McKee.\* The child was four days old, and the eye had become inflamed and began discharging the day before. The clinical picture presented severe swelling of the lids with profuse virulent discharge, edema of the bulbar conjunctiva, blennorrhoea neonatorum. The cornea was intact. The left eye was not involved, so was immediately protected. Smears were made and media inoculated. The stained slide showed a few Gram positive bacilli—the xerosis—and numerous Gram negative bacilli which looked like the colon bacillus. The gonococcus was not present.

The author ordered irrigation of the conjunctival sac every half hour with warm boracic solution. The discharge gradually ceased, and on the fifth day the eye was quite well. The cultures showed growths of the *bacillus coli communis* with a few colonies of the xerosis bacillus.

The case is of interest, says the author, inasmuch as the infection was caused by the *bacillus coli communis*, but gave the clinical picture of the blennorrhoea set up by the gonococcus. Axenfeld reported a case

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\**Montreal Med. Jour.*, October, 1906.

in 1896, and later Bult. They both emphasized the fact that *blennorrhoea from the colon bacillus runs a much milder course than that caused by the gonococcus*.

As in most cases of the disease it is impossible to evert the lids or even to retract them sufficiently for the application of remedies, R. C. Matheny uses *two pairs of forceps*, like ordinary ciliary forceps but with rubber tips 5 mm. wide. Taking a pair in each hand a firm hold is taken of either palpebral margin and the lids drawn away from the eye-ball. The nurse or assistant then thoroughly irrigates the conjunctival sac, the fluid is drained off and with the lids thus averted the nitrate of silver or other remedy is thoroughly applied.

G. Thomsen von Colditz (p. c.), after a year's experience in charge of the infectious ward of the Heidelberg University Eye Clinic, observed only one child who had lost its eye-sight after treatment by the following plan. The patient referred to was 6 months old and at the time of admission had large perforations of the cornea in both eyes.

In the early morning, wash out the conjunctival sac with a solution of hydrarg. chlor. corros. 1:5000. Then evert the eye-lids and brush them with a 3 per cent. solution of argentic nitrate. When the conjunctiva turns white, wash it off with normal salt solution. During the day, three to six times, according to the severity of the infection, the conjunctival sac should be irrigated with a 1:10,000 warm solution of potassium permanganate. The douche bag is elevated about half a metre above the patient's head, and one litre of the solution is used. During the day cold applications of a 1:5000 solution of potassium permanganate should be constantly applied to the patient's eyes. In the evening the conjunctival sac should again be irrigated with 1:5000 sublimate solution, followed by a few drops of  $\frac{1}{4}$  per cent. silver nitrate, dropped on the everted lids. A few minutes later sublimate salve is put into the eye. As the secretion lessens sublimate salve, twice a day and permanganate of potash applications three times daily, will suffice.

For *cleansing purposes* E. E. Holt (p. c.) uses a fountain syringe containing a quart of *warm, normal salt solution*, inserting the smallest point of the syringe at the outer canthus and *thoroughly flushing the conjunctival sac*. This should be repeated every one, two or three hours night and day, according to the amount of discharge and swelling.

#### **Ante-partum Ophthalmia.**

Thirty-five cases have been collected from the literature and ar-

ranged in table form by Stephenson.\* Seventeen additional cases have been collected and arranged in a second table (which have not before been reported) in which the ophthalmia developed within twenty-four hours after the birth of the child. This period of incubation being too short for infection at or after birth, points to *ante-partum infection*. Stephenson concludes as follows: "First, instances of ante-partum ophthalmia are not so uncommon as hitherto believed, and, second, about one-half of the cases (44.5 per cent.) are satisfactorily accounted for by a premature rupture of the membranes, allowing access of micro-organisms to the baby's conjunctival sac; third, in the remaining cases (55.5 per cent.) a slight injury to the membranes may determine access of micro-organisms, or infection through the uninjured membranes must be assumed to have taken place; fourth, increased temperature of the conjunctival sac *in utero*, enhanced virulence of the causative micro-organism, feebleness of the babies, slight lateral tears of the membranes, position of the fetus in the maternal passages, and the condition of the placenta can not be shown to be connected with the causation of ante-partum ophthalmia; fifth, several of the so-called "congenital" anomalies of the eyes, as corneal opacities, staphyloma, microphthalmos, cryptophthalmos and lachrymal abscess, are probably to be explained on the theory of an intra-uterine infection."

The *treatment* of these rare infections does not differ from that proper to post-partum ophthalmia.

#### **Purulent Conjunctivitis of Young Girls.**

As de Schweinitz (*Text-book*, p. 259) says: "Occasionally young girls are the subject of vaginitis, which in severe forms is associated with a purulent discharge, and in hospitals and asylums has occasionally assumed the form of an epidemic among the inmates. In a certain percentage of cases gonococci are present in the discharge, and the disease may be conveyed to the eye by the fingers, or gain entrance into the conjunctival sac from discharge adherent to bed linen, sponges, etc. There results a purulent conjunctivitis, with symptoms closely resembling those of ophthalmia neonatorum, although usually the manifestations are less violent, and the corneal complications less likely to occur than in the gonorrheal conjunctivitis of adults. To this disease the name *ophthalmo-blennorrhea*, or *gono-blennorrhea of young girls* has been given."

I have seen several epidemics of this sort in the childrens' wards of St. Luke's Hospital, the patients' ages ranging from 2 to 10 years:

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\**The Ophthalmoscope*, April, 1906.

Gonococci were found not only in the vaginal but (less often) in the conjunctival discharges.

*Treatment* should, of course, be that of purulent ophthalmia. The cases that I saw all made a good recovery and none exhibited corneal complications.

## CHAPTER XXXVII.

### TREATMENT OF DISEASES OF THE CONJUNCTIVA, CONTINUED.

*Acute Contagious Conjunctivitis*—"Pink-Eye"—*Membranous Conjunctivitis*—*Diphtheritic Conjunctivitis*—*Pterygium*—*Pinguecula*—*Injuries to the Conjunctiva*—*Subconjunctival Hemorrhage*—*Argyrosis of the Conjunctiva*—*Tuberculosis of the Conjunctiva*—*Xerosis of the Conjunctiva*—*Parinaud's Conjunctivitis*—*Pemphigus of the Conjunctiva*—*Syphilis of the Conjunctiva*—*Episcleritis and Scleritis*—*Episcleritis Partialis Fugax*—*Sclerokeratitis*—*Injuries to the Sclera*—*Diseases of the Caruncle*.

#### **Acute Contagious Conjunctivitis.**

*Koch-Weeks conjunctivitis. Epidemic conjunctivitis. Acute mucopurulent conjunctivitis.*

This is a disease produced by specific infection, commonly known as "pink-eye." The active agent is a small bacillus first studied by Weeks and which may be found in the discharges. In addition to this epidemic form of the disease there are other contagious varieties of mucopurulent conjunctivitis, the diagnosis of which should, when possible, be made by laboratory examination of the excretions. Indeed, in every case of ocular inflammation with discharge the secretions should be examined bacteriologically so that a proper diagnosis and prognosis can be made. Thus, we have acute contagious conjunctivitis, set up not only by the Koch-Weeks bacillus but well-defined inflammations, contagious in character, mainly due to the pneumococcus, to staphylococci, to the streptococcus pyogenes, to the diplococcus of Morax-Axenfeld, to the diphtheria bacillus, to the gonococcus, the xerosis bacillus, etc., as well as to mixtures of two or more of these. Although certain principles underlie the treatment of all these forms of infectious conjunctivitis, they will be separately discussed.

The *therapy is generally that of acute catarrhal conjunctivitis*, with the addition of the application to the lids, to prevent their adherence during the night, of a little pure lard, cold cream, boric acid ointment or some other mild form of salve. The following ointment is as useful for that purpose as any.

R

Acid. boric.

gr. x

Lanolin.

Vaselin. alb.

āā ʒss



Weeks prefers in "pink-eye" a 1:10,000 solution of sublimate and iced compresses during the acute stage of the disease.

zur Nedden recommends in influenza conjunctivitis a collyrium of oxycyanide of mercury (q. v.) with cold applications.

### **Membranous Conjunctivitis.**

*Croupous conjunctivitis. Diphtheritic conjunctivitis. Pseudo-membranous conjunctivitis. Plastic conjunctivitis.*

This disease is the result of various pathological causes, some of them chemical and others due to bacterial invasion. Among the latter are the Koch-Weeks bacillus, the gonococcus, the diphtheria bacillus, Pfeiffer's bacillus, the xerosis bacillus, the streptococcus, as well as mixed infections that sometimes include staphylococci.

After a *careful bacteriological examination* the treatment should be conducted with particular reference to the findings. When the Klebs-Loeffler bacillus is present *diphtheria antitoxin* (q. v.) should be injected. As a local application aristol is of value when the cornea is involved. The adjunct *treatment* of an ordinary case of membranous conjunctivitis should begin with the protection of the unaffected eye by a Buller's shield. The application of ice compresses or cold applications should be made in the early stages. The conjunctival sac should be irrigated at least three times a day with boric acid in 1-5000 of bichloride. When the membrane begins to separate silver nitrate in weak solution may be employed. Just previous to the stage of sloughing, some surgeons advise sprinkling the exudation with powdered sulphate of quinine, or to paint a saturated solution, in water, of that agent, thoroughly over the conjunctiva.

In *diphtheria of the conjunctiva* Nicati advises the following mixture of loretin (q. v.), to be dusted on both the infected areas and upon the lids externally, the whole to be covered by a sterile, cotton bandage:

R

Loretin.

Calomel.

Pulv. acid. boric.

āā 1.00 (gr. xv),

50.00 (ʒii).

A good resumé of the *methods employed in the treatment of this serious disease* is given by de Schweinitz. He says (*Text-book*, p. 240) that during the earlier stages cold compresses are of doubtful value because, as corneal involvement is almost inevitable, hot effusions are more suitable. The eye should be frequently cleansed with warm boric acid solution and atropine drops instilled, which, if the ulceration of the cornea is peripheral, may be associated with eserine. *Iodoform salve* (or powder) should be freely applied within the con-

junctival sac; indeed, vaseline itself is efficient under these circumstances. Besides the collyria mentioned, solutions of *salicylic acid* or of carbolic acid in glycerin have found favor. Fieuzal advises *lemon juice and citric acid* ointment.

"Internally, quinine, iron and mercury are useful; the first in suppositories and the last either as calomel or as the bichloride; of the latter 1/60 to 1/40 of a grain may be given hourly to a child from 3 to 6 years of age. Of all the remedies named, however, recent experiences indicate that the greatest reliance should be placed upon *diphtheria-antitoxin*, which should be administered exactly as it is in ordinary faucial diphtheria.

The sound eye should be guarded by a bandage, or by Buller's shield. Isolation of the patient is necessary, especially if the disease appears in the neighborhood of children who suffer from facial eczema or any form of catarrhal conjunctivitis."

#### **Pterygium.**

Pterygium is a thickened, triangular fold of conjunctiva with its apex, or head, on the cornea and its body and base spreading out, *like a fan*, towards either canthus. It may *develop from a pinguicula* (q. v.), is usually situated on the nasal side of the cornea but sometimes appears on the temporal side. It rarely appears above or below or in two situations at the same time.

In the early stages it is highly vascular, with a tendency to advance slowly over the surface of the cornea towards its center, often as far as the pupillary area. In the latter case vision is permanently interfered with. Later on, it ceases to grow, loses its vascularity and becomes thin, pale and atrophic. It is a cause of considerable disfigurement, acts as a nidus for bacteria, and, in a number of other ways, sets up a good deal of irritation. *It is not safe to perform any operation that involves the opening of the eyeball while it is present.*

It is usually found in subjects who are exposed to wind, dust and other irritating influences, especially in *farmers, motormen, cab drivers, sailors*, etc. The starting point of a pterygium is usually a small ulcer at the corneal margin, in which a fold of the conjunctiva becomes caught during the process of healing and is drawn into the healed area. This leaves a roughened surface at the limbus upon which foreign bodies readily lodge and from which the protecting epithelium is easily removed; there is a succession of ulcers and the growth advances apace.

*Treatment.*—The growth may be removed by some of the various operative measures at our disposal. One of the best is that devised by McReynolds.

Although the treatment of this growth is almost exclusively operative, yet there are a few procedures that either check its progress or bring about a cure when it is small and thin. The former is by electrolysis or by the destruction of the apex of the growth by the actual or galvano-cautery. For the same purpose the application of strong nitric acid has been recommended by some surgeons.

#### **Pinguecula.**

Is a small, yellowish-white elevation in the ocular conjunctiva, usually situated near the corneal limbus towards the outer or inner canthus. It is composed of thickened connective tissue and is not a fatty deposit, as its appearance and name might suggest. It is an innocent growth, except when it is a *forerunner of pterygium* (q. v.), and rarely requires removal.

#### **Injuries to the Conjunctiva.**

These take the form of foreign bodies, parasitic animals, burns, scalds, gun-powder injuries, ruptures of the membrane by blows, etc.

In *burns of the conjunctiva* the chief anxiety is to prevent symplepharon, traumatic ectropion and entropion. A burn should be treated as early as possible. When from strong alkalies the sac should be irrigated with a very weak mixture (about one per cent.) of vinegar. In *burns by lime* the foreign substance should be removed at once by irrigation with cold water or, if that is not possible, by means of a spud or knife blade. This should be followed by the instillation every hour of the following collyrium:

R

Sod. borat.	gr. xx
Holocain. hydrochlor.	gr. i
Adrenalin. hydrochlor. (1-1000)	fl. ʒii
Aquæ dest.	fl. ʒii

*Burns from strong acids* should be neutralized at once by an irrigating solution of sodium bicarbonate—1 or 2 per cent.

After the treatment, as above, of all the various forms of burns a little warm vaseline, castor oil, or olive oil should be dropped into the conjunctival sac before the usual dressing is applied. To *prevent symplepharon* the opposing surfaces should be separated by a probe several times daily. Coover and Black advise the use of an *egg-skin* placed between the opposed raw surfaces. This should be applied fresh and changed daily.

Burns of the eyelids and *conjunctiva*, especially by lime, are of frequent occurrence. It has long been known that a *saturated solution of picric acid* is one of the best applications to a skin burn, relieving the pain in a marvellous manner and acting as a powerful anti-

septic. A. Fortunati after making experiments with rabbits's eyes and after long clinical experience, warmly recommends picric acid for treating burns of the conjunctiva and cornea, especially by chemical agents, including lime. He finds that a 2 per cent. ointment—*picric acid, 20 centigrams to white vaseline (neutral reaction) 10 grams*—is better than a watery solution. He applies it twice or thrice in the day after the instillation of a few drops of cocaine. The results are surprising, especially in the direction of relieving pain. Symblepharon is infrequent after the picric acid treatment. (*British Medical Journal*, August 28, 1908.)

*Gunpowder injuries* should be treated by anesthetizing the parts and picking out the powder grains with a spud or discission needle and scissors.

#### **Subconjunctival Hemorrhage.**

Smooth, painless, bright-red patches involving from 1-10 to  $\frac{1}{2}$  the scleral surface do not, as a rule, call for much treatment, as they generally disappear by absorption whether treated or not. If it is thought necessary to prescribe, the following lotion in conjunction with cold applications (q. v.) will be found as effective as any:

R

Sodii chloridi	0.972 (gr. xv),
Acidi borici.	1.296 (gr. xx),
Aquæ camph.	
Aquæ dest.	āā 60.00 (fl. ʒij).

#### **Argyrosis of the Conjunctiva.**

##### *Argyria conjunctivæ.*

The long continued application of *any of the soluble salts* of silver may result in a dark stain of the conjunctiva, just as the use of iron sulphate produces a yellow discoloration.

Argyrol and the other organic salts of silver stain more quickly and more deeply than the metallic compounds—like the nitrate or oxide, for instance.

The silver is deposited in the conjunctival tissue in the form of an albuminate or oxide. Very little can be done to relieve this condition, although subconjunctival injections of a one per cent. solution of potassium iodide may be tried. (See *Silver Salts*.)

#### **Tuberculosis of the Conjunctiva.**

Is much more common than was at one time suspected. It may readily be mistaken, for instance, for phlyctenules. Sattler divides these infections into a number of groups, the miliary ulcer, yellow gray nodules, granulation tissue and the so-called "lupus" of the con-

junctiva. In addition to curetting the growths (when large enough) the X-ray treatment is most valuable. Afterwards a dusting powder of *iodoform*, *aristol*, *xeroform*, or *calomelol* (q. v.) may be used, as well as a cleansing wash of formalin, 1-5000, applied four or five times daily. The employment of therapeutic doses of *tuberculin* is also in order.

As we know that the conjunctiva is sometimes the gateway to a general infection the systemic treatment of this disease should not be ignored, even if there be no distinct evidence of general tuberculosis.

#### **Xerosis Conjunctivae.**

*Atrophy of the conjunctiva. Xerophthalmus.*

Some authorities regard this condition as *distinct from pemphigus*. When it occurs after diphtheria of the conjunctiva, burns, chronic trachoma, or in persistent lagophthalmus, it generally requires a different treatment than that accorded to conjunctival pemphigus. Unfortunately *local treatment is of little value*. The sac should be kept clean with a simple, detergent collyrium (q. v.), while pure cod liver oil, castor oil, or a mixture of equal parts of glycerine and water may be prescribed with relief of many of the symptoms.

#### **Parinaud's Conjunctivitis.**

*Lymphoma of the conjunctiva.*

This uncommon affection consists in the development of polypoid granulations of the conjunctiva. The onset of the disease is characterized by great swelling of the lids, involvement of the conjunctival lymph follicles, swelling of the neighboring glands and is associated with a general infection—slight rigors and rise of temperature.

*Treatment.* Parinaud advised the use of *nitrate of silver*; Gifford found good results following the application of copper sulphate; Abadie recommends the use of galvano cautery, while other ophthalmologists employ *iodoform ointment*, or solutions of tannin or sodic hypophosphite in from 5 to 10 per cent. strength. Exsection of the enlarged lymph follicles has been recommended. It must be remembered in treating this disease that however formidable it may at first appear, the tendency is towards resolution; a large majority of cases get well with or without treatment.

#### **Pemphigus of the Conjunctiva.**

This is a rare disease, generally associated with pemphigus of other parts of the body. When the disease attacks the eye the bullæ slowly cicatrize, shrink and produce considerable deformity. With the exception of the internal administration of arsenic, the irrigation of the sac with a mild cleansing liquid, such as normal salt or boric acid solution and the application of pure castor oil, bichloride ointment, or

some other antiseptic emollient to the conjunctival sac, little or nothing can be done.

### **Syphilis of the Conjunctiva.**

Not only *hard and soft chancre* but *gumma*, *papular syphilides*, *mucous patches* and a *specific catarrhal conjunctivitis* resembling the follicular form of trachoma, are known. The *treatment* of all these should, of course, be anti-luetic, combined with the exhibition of suitable local remedies.

The tumors mostly call for operative interference and the employment in those of recurrent disposition, of the X-rays or *radium* (q. v.).

Aubineau (*Annales d'Oculistique*, July, 1907) reports\* a case of *hard chancre of the conjunctiva*. On the conjunctiva of the lower lid there was a yellowish-white exudate, ten or eleven mm. long and three or four wide, which had the appearance of a very adherent false membrane. The preauricular gland was swollen to the size of an almond, hard and indolent. A week later the exudate had invaded the cul-de-sac and extensive chemosis soon appeared. The lower lid commenced to swell and the sub-maxillary glands became involved. The eyelid was edematous and induration prevented eversion of the lid. The exudate lost its pseudomembranous character and was replaced by a shallow ulcer with irregular outlines, whose whitish color contrasted with the red of the surrounding conjunctiva. At the end of three weeks *spirochetes* were found in scrapings from the ulcer and a week later there was well marked syphilitic roseola, and *treatment with bichloride was commenced*. In five or six weeks the cornea became cloudy, with the appearance of parenchymatous keratitis. At the end of two months the search for *spirochetes* was negative.

The final result at the end of ten months was as follows: The skin of the lid was flabby, the lashes had disappeared, the palpebral conjunctiva was cicatricial and dermatised. There was an extensive symblepharon, the cornea was cloudy and vision was reduced to counting of fingers, a result that it seems likely that an earlier and more vigorous mercurial treatment by inunction or injection might have considerably modified.

Among the diseases of the conjunctiva unaffected by non-surgical methods or not reached by any treatment are *conjunctivitis petri-ficans*, *amyloid disease*, *emphysema*, *conjunctival lymphangiectasis*, *leprosy*, and many tumors and cysts.

### **Diseases of the Caruncle.**

Diseases of the caruncle are usually transmitted from the con-

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\*Review in *Ophthalmology*, July, 1908.



junctiva and should be treated in conjunction with it. *Many tumors* (papilloma, epithelioma, adenoma, sarcoma, etc.,) attack this small body and call for the same treatment they should receive in other localities. "Wild" hairs and foreign bodies should be removed in the usual manner.

### EPISCLERITIS AND SCLERITIS.

The subconjunctival tissue of the sclera is inflamed in the former, the sclera itself in the latter; but it is difficult to separate the one from the other. There are scleral injection, pain more or less severe, lachrymation, photophobia and swelling of a purplish color at the point affected—usually 3 to 4 mm. from the sclero-corneal junction. Tenderness may be present over the site of the inflammation.

The symptoms are apt to be more severe in scleritis, in which the tension of the eyeball may be increased, followed by staphyloma or ectasia of the anterior portion of the globe.

It is not a common affection and is likely to be mistaken for conjunctivitis and iritis. A little care will detect the circumscribed, reddish swelling or swellings which characterize the disease. After recovery, bluish or dark pigmented patches remain to indicate the site of the acute lesion. It is more frequent in women than in men, is often obstinate and chronic and is nearly always found in individuals who have rheumatism or gout. The inflammation may extend to the uveal tract, setting up an iritis, cyclitis or choroiditis.

*Treatment.*—Hot fomentations should be frequently applied (at least every two hours). A 1 per cent. solution of sulphate of atropin should be used sufficiently often to keep the pupil well dilated:

℞	
Atropin, sulphatis	gr. iv,
Aq. dest.	f. ʒj.

To this prescription 5 grains of *dionin* can generally be added with decided advantage.

*Smoked protective glasses* (q. v.) should be worn, with complete rest of the eye. When there is much pain and pericorneal injection the natural or artificial leech should be applied to the temple. The *subconjunctival injection of normal salt solution*, or 1-5000 solution of bichlorid of mercury, sometimes proves useful in obstinate cases. Pilocarpine sweats and iodide of potassium may be used with success, especially where the deeper structures of the eye are affected.

*The rheumatic, gouty or tubercular taint* should be neutralized by appropriate remedies. *Tuberculin* (q. v.) should be employed, both as a diagnostic and as a therapeutic agent, in cases of suspected tubercle.

The *internal treatment* is of considerable importance and it has



been found that pilocarpin, colchicum preparations (q. v.) sodic salicylate, aspirin and similar remedies act very well. Massage (q. v.) in its various forms with mercurial ointment has been shown by Darier to be of considerable use.

On the whole *dionin*, as advocated by Connor, acts very nicely. Subconjunctival injections of *sodium cinnamate* (q. v.), normal salt solution and *sodic salicylate* (q. v.) have also been recommended. Attention must be called to the fact that the episcleral patches are sometimes merely aggravated forms of *angular conjunctivitis* (q. v.) and call for the local exhibition of zinc salts, or they may be *tubercular deposits* that require the usual methods of diagnosis and treatment. In addition to the foregoing applications hyoscin may be ordered and should be instilled as a one-tenth per cent. solution once or twice a day to keep the pupil well dilated.

For the interfibrillary deposits commonly left after the scleritis has subsided, massage with brown ointment (q. v.) and internal administration of thiosinamine (q. v.) (two grains three times a day) will be of considerable assistance.

The resources of *hydropathy* and a residence at some health resort where baths, water-drinking, dieting and out-of-door exercise are fashionable are not to be forgotten in the conduct of this frequently stubborn disease.

The raised and generally *pigmented exudates* of scleritis commonly give trouble. When the inflammation is beginning to subside these *plaques* should be treated by daily massage with the following as an adjunct to other applications:

R	
Sodii iodidi	0.25
Petrolati	10.00

*Painting the lids with the tincture of iodine* is a favorite remedy with some surgeons. Thus, Peuch advises it to remove the deposits in *all forms of deep scleritis*, applying the remedy daily for five days. This procedure is occasionally employed in chronic iritis and other inflammations of the uveal tract. Its action is, of course, that of a counterirritant (q. v.).

Homer E. Smith (p. c.) finds that, in this disease, *aspirin internally* and in full doses is preferable to the salicylates.

H. Bailey, (p. c.) uses half a grain of pilocarpin to a fluid ounce of water instilled into the eye three times a day.

#### **Episcleritis Partialis Fugax.**

*Gouty eye. Hot eye. Fugacious episcleritis. Sub-conjunctivitis (von Graefe).*

This condition is always an expression of gout or rheumatism, especially the former. It disappears under *saline laxatives*, Turkish baths, restriction of the diet and the local application of a five per cent. solution of dionin with atropia, assisted by hot fomentations, two or three times a day.

#### **Sclerokeratitis.**

*Scrofulous scleritis. Deep scleritis. Sclerokerato-iritis.*

This is one of the most troublesome forms of scleral disease. It is nearly always a stubborn, chronic affection, the process generally involving the uveal tract as well as the cornea. Discouraging relapses occur in spite of the most judicious conduct of the case and the eyesight is threatened through posterior synechiæ, vitreous opacities and corneal exudates. Discolored, bulging patches remain to show the site of the disease.

Allied to this serious disease are *annular scleritis* and *sclerotizing keratitis*, both of them responding but little to remedies.

*Treatment.* *Dionin*, beginning with a 5 per cent. solution and increasing the dose (as it loses its effect) until the *powder* is employed, acts well in conjunction with other local applications, especially atropine and oxycyanide injections. In these diseases it is especially necessary to bear in mind and treat the general dyscrasia. During that treatment *hydropathy* in combination with pilocarpine sweats, is almost always helpful. Examine the nasal passages and, especially if relapses occur, change of air to an out-of-doors health resort where treatment can be carried out under the direction of a competent ophthalmologist, will often be efficacious.

T. Herbert Parsons has described a rare *circumcorneal form* in elderly subjects, showing a deep, brawny infiltration of the tissues. Beginning at the sclero-corneal junction it spreads towards the center of the cornea as well as to the equator. The deeper parts of the eye are involved later and the eye is generally lost in spite of all treatment.

#### **Injuries to the Sclera.**

These are *simple*, *perforating*, and *compound* according to the character of the agent producing the trauma. Foreign bodies may also lodge in its tissues.

The treatment is mostly operative, although the removal of foreign bodies and the disinfection of all lesions are most important.

*Ectasia (acquired)* of the sclera, staphyloma of the sclera, serious injuries of the sclera, sclerosing scleritis, pigmentation of the sclera, congenital anomalies and tumors are unaffected by the forms of treatment contemplated by this work.

# CHAPTER XXXVIII.

## TREATMENT OF DISEASES OF THE CORNEA.

*Foreign Bodies in the Cornea—Corneal Ulcer—Simple Ulcer—Deep Ulcer—Spreading Ulcer—Serpent Ulcer—Rodent Ulcer—Mooren's Ulcer.*

### Foreign Bodies in the Cornea.

A. Duane (p. c.) finds *fluorescein* useful in mapping out the foreign substance which stands out sharply as a dark spot in the midst of a green or yellow-green area.

L. R. Ryan (p. c.) always touches the denuded area, after removal of the foreign body, with the point of a toothpick soaked in 95 *per cent.* *phenol* and has not seen an ulcer follow in several thousand cases.

### Corneal Ulcer in General.

In their usual manifestations corneal ulcers are due to the entrance into the corneal substance of some of the micro-organisms productive of inflammatory conditions. The virulence of the infection chiefly depends upon the nature of the bacterium, whether it be the gonococcus, streptococcus, staphylococcus, pneumococcus or other germ.

In the earliest stage of ulcer one first notices a localized, hazy appearance of some part of the corneal surface, after which the epithelium covering this area breaks down, allowing one or more pathogenic microorganisms to penetrate into the corneal substance. Injury to the cornea in some form or other (commonly removal of the protective anterior epithelium) is usually secondary to a purulent or mucopurulent inflammation of the conjunctiva, tear passage or nasal mucous membrane.

Randolph has recently shown that bacterial ptomaines or toxins produce the same destructive effects as the bacteria themselves.

*Clinical varieties.* Once established, the ulcer may continue to be merely superficial and heal in a few hours, especially if no serious infection has taken place. In other cases it spreads in the anterior layer of the cornea towards the pupil or it remains near the periphery, following the sclero-corneal margin; or it may penetrate deeply into the substance of the cornea and perforate into the anterior chamber. With the exception of small, superficial ulcers, which are often nothing more than mere abrasions of the corneal epithelium without serious infection of the exposed surface, opacities of the cornea invariably follow ulcers in this situation.

Vision is often affected by the scar that forms in the cornea, the defective sight depending upon the situation and density of the cicatrix. *Vision is greatly interfered with when the pupillary area is involved; it is generally unaffected when the opacity is situated elsewhere.*

Owing to the fact that in old age the nutrition of the cornea is easily lowered, corneal ulcers are more common in advanced life than in early youth. As a result of their unsanitary surroundings and manner of living the poorer classes are more prone to ulcer of the cornea than the well-to-do. In the former the resisting power of the cornea to the entrance of pathogenic micro-organisms is insufficient and ulcers are liable to follow abrasions and other minor injuries of the cornea, especially in the presence of a previously infected conjunctiva.

*The detection of corneal ulcer* presents few difficulties if it is at all extensive, although small and superficial ulcerations of recent origin are comparatively easily overlooked. In most cases there will be noticed a slight infiltration of the cornea, giving its surface a steamy appearance, while the epithelium will have lost its polished appearance, differing in this respect from a true scar, which is covered with normal epithelium. Again, if the reflection from a window be allowed to fall upon the affected cornea the image of the cross bars will appear broken or irregular. One of the surest means of detecting the presence of an ulcer is to allow a few drops of a *two per cent. solution of potassium-fluorescein* (q. v.) to flow over the surface of the cornea:

R

Fluorescein.	gr. viii
Liq. potassæ	f. ʒi
Aquæ dest.	f. ʒii.

This solution renders the denuded surface of the cornea *green or greenish yellow and accurately maps out the limits of the ulcer.*

The stained part represents either (1) an ulcer not yet covered with epithelium; or (2) an abrasion of epithelium; or (3) epithelium in diseased condition, though not necessarily in a dying state. The fact of staining is not therefore to be in all cases taken as an indication for active treatment (though this doctrine is often taught) for in many cases an ulcer which stains is nevertheless healing quite satisfactorily, and the fact of the epithelium taking on the stain is not necessarily an indication that an ulcer will certainly form.

Frölich believes that a 20 per cent. alkaline *escorcin* (q. v.) solution is the best test for corneal ulcers and abrasions as the red color of the alkaline *escorcin* solution shows more plainly on the cornea than the green of fluorescein.

*General Treatment of Ulcer.* Enquiry should always be made as to the state of the digestion; indeed, into the condition of the entire

alimentary tract, inasmuch as dyspepsia in its various phases—to say nothing of a vicious or defective metabolism and the resulting auto-intoxication exercises an evil influence on the course of all forms of ulcer. Both the urine and blood should be similarly examined and any necessary treatment carried out. The dietary and habits of the patient must be regulated; he should lead as sanitary a life as possible. Any strumous, gouty, rheumatic, luetic or other taint should be neutralized. The patient's nose and neighboring passages should be explored for any source of infection and if found ought to be promptly treated. The lachrymal passages should be examined and put in order; the teeth should be treated, if need be, by a competent dentist.

As a rule, patients that have for some time suffered from *ulcus corneæ* are helped by tonic doses of strychnia and iron and by a generous supply of first-class, well-cooked food.

#### Simple Ulcer.

This is the most common variety of this affection, and is *usually due to a slight traumatism*, for example, a cinder or other particle of foreign substance getting into the eye and abrading the corneal surface. The infection may be furnished by and be secondary to a diseased condition of the conjunctiva, either confined to the palpebral or ocular portion or affecting both. Although this form of ulcer may extend into the cornea proper its tendency is to heal without further loss of substance.

R. L. Randolph (p. c.) sees a great many cases of foreign body in the cornea of railroad men from the shops. Generally the foreign substance is either a particle of rust or a minute piece of emery. When he sees the patient the foreign body has generally been picked at and an *infected ulcer* is present. When every trace of the extraneous substance has been removed he finds this collyrium most soothing and antiseptic:

℞	
Holocain.	gr. ss
Sod. chlor.	gr. iii
Aquæ dest.	f. ʒii

A small quantity is given, for healing usually takes place in from 24 to 48 hours.

*If the ulcer be small and there is difficulty in its detection a drop of the two per cent. solution of fluorescein just referred to will immediately reveal its existence.* If it be large enough to be readily seen it will have a slightly scooped-out appearance with a grayish floor and a circumference surrounded by infiltration. There will be more or less circumcorneal congestion whose extent will depend in a great measure

upon the situation and extent of the ulcer. It will then be attended by *pain more or less severe, photophobia, blepharospasm and lachrymation*, while the pupil will be slightly contracted. When it undergoes repair the depression fills up with new tissue which soon becomes covered with epithelium, leaving a whitish scar. The opacity becomes less dense, as time goes on, and in some instances disappears entirely.

*Treatment.*—One drop of one per cent. solution of atropin sulphate should be instilled into the conjunctival sac at once and continued once or twice daily or often enough to keep the pupil dilated.

The application of hot water (as hot as can be borne) should be kept up every one to three hours, depending upon the amount of inflammation and pain present. This should be followed by washing out the conjunctival sac with a mild antiseptic lotion: boric acid solution, 3 per cent.; solution hydrarg. bichlorid, 1 to 10,000; solution permanganate of potassium, 1 to 4,000, etc.

*The eye should not be bandaged*, but covered with an eye shade, a piece of sterilized gauze being placed between the eye and the shade. The cornea and conjunctival sac should be carefully examined, foreign bodies should be removed and diseased lids treated with appropriate remedies. Tonics and other proper remedies should be given when the general health is at fault.

De Wecker believed that when properly carried out there is no remedy in all forms of corneal ulcer equal to *subconjunctival injections*. The eyelashes and lid-edges are first scrubbed with a 1:100 solution of oxycyanide of mercury (q. v.) and the eye thoroughly irrigated with a saturated (4 per cent.) solution of boric acid. The eye is then cocainized and 15 drops of the following is to be *injected beneath the conjunctiva, as near the ulcer as possible*:

R

Hydrarg. bichlor.	gr. $\frac{1}{4}$ (0.015),
Eserin. salicylatis	gr. i (0.05),
Aquæ dest.	fl. $\overline{3}$ iiiiss (100.00).

This should be repeated daily if required, but the dose ought to be diminished when improvement is noticed. The injection should be followed by a bandage.

If *iritis be present* scopolamine should be substituted for the eserine.

Albert R. Baker (p. c.) follows a routine treatment of ulcer of the cornea somewhat different from that of most ophthalmologists. At the same time the plan strikes him as rational. Upon the first visit the patient is directed to bathe the eye in hot water for half an hour. Then the cornea is stained with fluorescein. Now, with a piece

of cotton tightly wrapped around the end of a wooden tooth-pick and dipped in 1:250 solution of mercuric bichloride, it is applied to the ulcer with a sort of rolling motion between the fingers until the fluorescein stain entirely disappears. Cocain or eucaïn may be used to render this act painless. Then atropia is instilled and the whole eye subsequently dusted with fine boric acid powder. A compress is applied to both eyes. This treatment may be given daily until a cure is brought about.

A. E. Prince (p. c.) has long used with success a 10 per cent. solution of salicylic acid in alcohol as an application to *small corneal ulcerations*.

I have used *iodine trichloride* (q. v.) in its pure form as a *cauterant in the simpler forms of corneal ulcer* and if the preliminary cleansing and other accessory precautions in the treatment of this disease are regarded I believe it to be a reliable agent for the purpose. (See *Cauterants*.)

After scarifying the blood-vessels about the corneal margin in *superficial ulcer* Webster Fox (*Text-book*, p. 157) advises the use of the following formula:

R̄	
Daturin, sulph.	gr. ss
Acidi boracici	gr. vj.
Acidi carbolici	m. j
Aquæ dest.	fl. ʒj.

Five drops into the eye four times daily.

Dolganoff claims that in corneal ulcer *subconjunctival injections of parachlorophenol* (one per cent. in water) are quite as effective as mercuric cyanide or bichloride and not nearly so irritating and painful. The phenol compound really acts as an analgesic and the discomfort following the injection is small or lasts only a few minutes.

A very effective cautery for *corneal ulcer* is a 30 per cent. solution of *lactic acid*. After staining and cocainizing the affected cornea a pointed, wooden tooth-pick is dipped into the fluid and thoroughly but carefully applied to the diseased area. A small slough separates in a few days.

Similar results are obtained by the application of a few crystals of *sozoiodolate of zinc* (q. v.).

C. M. Hobby (p. c.) advises as a cauterant a 95 per cent. alcoholic solution of *iodine* (saturated) into which an equal amount of *crystals of phenol* has been placed. This mixture is carefully applied with a tooth-pick to the ulcerating surface. He prefers it to the electric cautery because, in his hands, he has been able to limit its effects better than he can the cautery or any other agent.



*Iodized carbolic acid* or *solution of iodine* in glycerine-carbolic acid (q. v.) is one of the preparations of the National Formulary. *Applied pure to corneal ulcers* it is one of the best cauterants and germicides we possess. I believe it to be in that respect even *better than pure tincture of iodine* or *pure phenol used alone*. Of course, it is to be carefully rubbed into the stained, cleansed and cocainized cornea by means of a pointed toothpick or wooden match soaked in the fluid.

As a caustic application to *corneal ulcer chromic acid* (q. v.) is also of considerable value. The acid, fused on the tip of a silver probe, should be carefully applied to the cocainized eye so as to destroy as little as possible of the healthy tissues. The ulcer must be previously stained with fluorescein and afterwards gently irrigated with a 2 per cent. sodium chloride solution.

*Trichloracetic acid* is an effective *cauterizing agent for corneal ulcers*, to be applied pure on the end of a wooden toothpick or pointed match soaked in it, any excess of acid to be removed from the applicator before the cauterization is begun.

The *trichloracetic acid* application should be carefully made. D. H. Cooyer (p. c.) advises the use of a 10 to 25 per cent. solution once daily. The eye should be anesthetized and the application made with a tooth-pick directly to the ulcerated area, hot fomentations being applied frequently to relieve pain.

C. D. Cadwell (p. c.) prescribes in *corneal ulcer* due to the diplobacillus:

℞	
Ammonio-ichthyol.	0.15
Zinc. oxid.	5.00
Vaselin. alb.	15.0

To be thoroughly mixed and applied both to the inside and outside of the lids.

James A. Spalding (p. c.) finds that an ulcer that does not yield to the local application of tincture of iodine, carbolic acid or the cautery may be cured by the use of the following:

℞	
Zinci sulphat.	0.12
Aquæ dest.	30.00

A drop or two to be applied directly to the ulcer with a cotton-tipped probe, or it may be used as an ordinary collyrium once or twice a day. Many people dread caustics and cauteries and as a substitute this lotion is of value.

In intractable, superficial *ulcer* Webster Fox (*Text-book*, p. 157) has found subconjunctival injections of great value. He uses the following formula:

R

Sodii saccharat.

gr. xv

Aquæ dest.

fl. ʒi

Chandler and Risley have reported favorably on the use of a 10 per cent. ointment of *casseriþe* (q. v.) in the treatment of corneal ulcer. Although distinctly antiseptic, it may be freely rubbed into the conjunctival folds two or three times a day, the application to be followed by boric acid lotion and a pressure bandage.

F. A. Morrison (p. c.) prefers the following formula as a dusting powder, to be followed by the use of a compress for a short time:

R

Argyrol.

ʒss.

Pulv. acaciæ

ʒiiss.

Alexander Randall and J. A. Lippincott (p. c.) find that *boiling hot water* dropped slowly from a fine pipette on the ulcerating surface removes only dead tissue, meantime stimulating the living margins without injury to them.

Norton L. Wilson (p. c.) finds the following application, to be applied directly to the ulcer, of great benefit and thinks that no other is more effective except, perhaps, the galvano cautery:

R

Tinct. iodi

Phenol. glycerini

āā ʒi.

A. Barkan (p. c.) is much in favor of *cauterizing the ulcer with the blunt end of a steel strabismus hook*, heated in the flame of an ordinary alcohol lamp to a cherry-red heat. He touches the cocainized corneal ulcer with it quickly and rather forcibly so as to form a distinct though superficial eschar. The hook cools off immediately, although it burns thoroughly. This simple and safe proceeding may be repeated several times until the whole infected area is covered. The parts are then dusted with finely powdered iodoform, and a bandage is applied for 24 hours. This procedure, as is well known, was suggested by Gayet over 25 years ago.

G. C. Savage (p. c.) advises in corneal ulcer the use of *one drop of acetic acid in five or seven drops of water* once in twenty-four hours. His method of applying is to *touch the ulcer gently* with a piece of absorbent cotton wrapped round a tooth-pick, saturated with the above solution. The advantage of acetic acid over other agents is that while it destroys germs, as the other agents do, it does not destroy cell life, connective tissue, or the epithelium.

J. F. Clarke (p. c.) applies *tincture of iodine* to all forms of corneal ulcer and finds it acts promptly.

After the application of the *actual or other form of cautery* in ulcer of the cornea Goldzieher had advised gentle massage with the following salve once a day:

R	
Sodii sozoiodolatis	0.50 (gr. viii),
Atropiæ sulph.	0.05 (gr. i),
Vaselini	10.00 (3iiss).

### Deep Ulcer.

This is generally of the suppurative variety and is prone to involve the deeper layers of the cornea even to perforation of the latter. It follows, as a rule, injury to the cornea attended by infection from some pyogenic germ accidentally present in the sac; or infection may occur during a purulent inflammation of the conjunctiva due to the presence of the gonococcus, pneumococcus or other pus-microbe.

*This serious disease* is usually accompanied by severe pain in the eye and the frontal region, photophobia, lachrymation and congestion of the iris and ciliary body. Pus, fibrin with leucocytes and some pyogenic microbes frequently form in the anterior chamber (*hypopyon*) changing their locality according to the position in which the head is held. When the patient holds the head upright the hypopyon is at the bottom of the anterior chamber and appears there as a grayish white streak or it may extend to the margin of the pupil. If the patient lies down the pus gravitates to the outer portion of the anterior chamber.

The amount of purulent liquid varies; sometimes it almost fills the anterior chamber, while at other times the amount is so small that it can only be detected on closest examination. The quantity of pus in no way depends upon the extent and severity of the ulcer. *This so-called pus is often really sterile* since it is not, as a rule, derived from the ulcer itself. The membrane of Descemet forms a barrier that does not allow any foreign material to penetrate into the anterior chamber. The hypopyon is mostly made up of leucocytes derived from the iris, which wander from the bloodvessels of that structure and accumulate in the anterior chamber; sometimes the liquid of the hypopyon is very thick, at other times it is quite watery.

*Deep ulcer is usually round and varies in size. Its floor is covered with pus; its edges are frequently swollen and surrounded by a grayish infiltration. It has no tendency to spread, but its chief disposition is to open into the anterior chamber. When perforation is about to occur actual bulging of Descemet's membrane into the cavity of the ulcer may be observed on close inspection.*

When perforation takes place the aqueous humor gushes out; the iris is pushed forward and either becomes entangled in the corneal

opening, or (especially if the perforation be peripheral) suffers prolapse.

If the ulcer is situated in the center of the cornea (pupillary area) out of reach of the iris, the anterior capsule of the lens becomes applied to the perforation wound. In either case plastic material is thrown out which glues the iris to the margins of the corneal opening, preventing the escape of more aqueous and allowing the anterior chamber to reform. The iris thus becomes incarcerated in the wound and an *anterior synechia forms*. The ulcer heals and in time a dense white cicatrix (*leucoma adherens*) is the result.

If a decided prolapse of the iris has taken place, we are likely to have bulging of the affected cornea (*anterior staphyloma*) of greater or less extent, due to the action of the intraocular pressure on its weakened walls.

Fortunately, *perforation does not occur in all cases of deep ulcer* because the deeper layers of the cornea, and particularly the membrane of Descemet, are tougher than the superficial layers and are better able to resist the destructive process that is going on. *When it does occur its results are often disastrous*, not only on account of the marked interference with vision but, also, as a result of the *entrance of pyogenic micro-organisms into the interior of the eyeball*. The suppuration then extends to the internal structures and total destruction of the globe from panophthalmitis may follow.

*Treatment* consists, first of all, in the *disinfection of the ocular structures and especially of the discharges from a purulent or other form of conjunctivitis* that may be present. The pupil is to be dilated with a few drops of a one per cent. solution of atropia sulphate used sufficiently often to keep it in that condition. Even if no iritis is present, the atropin keeps the eye at rest by rendering the iridic and ciliary muscles inactive and thus checks the inflammation.

I am not able to subscribe to the doctrine that eserine or pilocarpin should be preferred as a local application in any form of peripheral ulcer while atropine is to be used when the ulceration is central. I am well aware of the reasons advanced for this teaching, the stimulation to the pericorneal blood-supply, that in the event of perforations of the cornea the miotic might prevent prolapse of the iris, and that it will relieve, while a cycloplegic will aggravate, a secondary glaucoma.

On the other hand, the danger of posterior synechiæ following a concealed iritis in peripheral ulcer is much more important and urgent than the doubtful advantage to be derived from the use of eserine. Indeed, having seen on a number of occasions ill-effects,

including the loss of several eyes, following the employment of eserin in deep, peripheral ulcer of the cornea, I would like to place myself on record as stating that if either a miotic or mydriatic is called for in corneal ulcer the latter should be used. I do not believe that the ocular tension induced by the ciliary congestion of a peripheral ulcer is seriously increased by the use of atropine, yet the protection from iritic adhesions through some mydriatic is not to be disregarded.

*Very hot applications*, in the form of hot fomentations, hot water bags or hot steam, should be used every hour or two for 15 to 20 minutes at a time. These are to be applied as hot as they can be borne—at a temperature varying from 115 degrees to 120 degrees, F. They may consist of hot water alone, hot chamomile (q. v.) tea or hot boracic acid solution (gr. 15 to the oz.). Hot applications not only stimulate the reparative powers of the tissues but are materially beneficial in relieving pain.

One effective method of application is as follows: A piece of sterilized gauze of several thicknesses is made into a pad large enough to cover the parts surrounding the eye. This is dipped into the hot water and wrung out so as to be moist (not wet) and applied to the ocular region. It must be changed frequently so that it is always *hot*: it must not be allowed to get cool.

Gentle but frequent *irrigation* of the conjunctival sac and ulcer with a mild antiseptic solution is a very effective measure. One may use for this purpose boric acid, 15 grains to the ounce, or corrosive sublimate, 1 to 10,000. The eye should be protected from the wind, as well as from dust and other foreign particles by a shade.

If there is danger of perforation a bandage should be applied, firmly but not too tight, in which case it is well to place a small quantity of absorbent cotton at the inner canthus to act as a pad and as a means of securing uniform pressure over the eyeball. When there is discharge from the conjunctiva the pad is contraindicated.

When *healing does not soon take place, or if the ulcer eats further into the corneal substance*, more active measures, looking to the removal or destruction of the pathogenic bacteria must be resorted to. *The floor of the ulcer may be scraped with an ordinary spud such as is used for the removal of foreign bodies or, more effective still, the actual cautery may be employed.* The outlines of the ulcer are first mapped out by instilling a two per cent. solution of potassium fluorescein, which stains the ulcer yellow-green, the eye is anesthetized, a fine tip is used with the *galvano-cautery* and applied white or red hot to every part of the stained tissue. *The end of a knitting needle, brought to a white heat and applied to the surface of the ulcer, makes a simple*

*cautery*. This may be repeated if necessary, but, if thoroughly done, is not usually required a second time.

Nicolai (ref. *Zeitschr. f. Augenheilk.*, Dec., 1907,) believes in the energetic treatment of hypopyon-ulcer with *zinc salicylate instead of cauterization*, either actual or chemical. In eight cases he instilled a 2 per cent. solution every two hours, syringing out the lachrymal sac with the same remedy every day. All the ulcers healed without operative interference.

Grey-Edwards (*Ophthalmoscope*, Feb., 1908,) reports three cases of hypopyon-ulcer, which resisted all treatment, including subconjunctival injections of cyanide of mercury. They healed quickly after the injection, in the back, of a vaccine of dead staphylococci.

According to the reviewer in the *Ophthalmoscope* (July, '07.) Darier\* appears to take a less enthusiastic view than usual of the efficacy of *serum therapy in uicer*. He details two cases of severe pneumococcus infection of the cornea, in one of which, the anti-diphtheritic serum of Roux, seemed to be effectual after other methods (notably cyanide of mercury subconjunctivally) had failed, and in the other, of which the same serum determined the cure of an ulceration which was hanging fire under argyrol dressings and paracenteses. As regards Roemer's anti-pneumococcic serum, Darier has failed to observe that it acts any differently from Roux's serum in corneal ulceration. It has given varying results in the hands of a number of authors. "It seems to result from all these observations that serum therapy cannot itself, in the majority of cases, bring about the cure of all infective ulcers. It is necessary to follow the clinical indications of each individual case, especially in the severe cases. For myself, three agents should be our first and most certain adjuvants, because they are absolutely harmless: (1) dionine in powder applied to the ulcer, (2) subconjunctival injections, (3) serumtherapy."

If perforation cannot be avoided it is better to anticipate it by *paracentesis* of the anterior chamber through the floor of the ulcer. This may be done with a paracentesis needle, an ordinary Graefe knife or with a keratome. It is also indicated when great pain is present, and especially if there is increased ocular tension, both of which it relieves in a very short time. It is much better to produce an artificial perforation in this way than to allow it to occur naturally, since prolapse and incarceration of the iris in the wound may be prevented. The wound may be reopened as often as is necessary by passing a fine probe between the lips thereof. If perforation does occur and

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\**La Clinique Ophthal.*, Feb. 10, 1907.



the iris engages in the wound, an effort should be made to replace the former. If this is impossible the prolapsed portion should be drawn forward with forceps and cut off flush with the corneal surface; the iridic edges are then freed and replaced with a spatula.

Our efforts should always be directed, in these cases of serious ulcer, to prevent anterior synechiæ and staphyloma. *If the perforation be near the periphery of the cornea*, a solution of eserine (q. v.) may be used, if possible, to contract the pupil and draw the iris away from the wound. Generally, however, atropia or some other mydriatic is preferable.

#### **Spreading Ulcer.**

*Serpent ulcer. Ulcus serpens. Sloughing ulcer. Rodent ulcer. Mooren's ulcer.*

These names are given to variants of one type—the ulceration that generally involves the surface of the cornea without specially destroying its deeper layers. As in the other forms of infective ulceration we first have an abrasion of the epithelial surface (most likely to occur in those exposed to wind, dust and such deleterious influences) followed by inoculation by discharges from a diseased conjunctiva or lachrymal apparatus, or nasal mucous membrane. Chronic conjunctivitis, dacryocystitis and ozena are not uncommon sources of the infection in sloughing ulcer. *The characteristic spread of this ulcer depends chiefly upon the presence of the pneumococcus* (which are often found in the discharge), although mixed infections are not uncommon. Pain is not a prominent symptom, although it may be quite severe in some cases. *Iritis may be present* and the inflammation extend to the ciliary region, in which case there is a marked circumcorneal injection. The ulcer usually presents a dull gray or yellowish floor and undermined edges, with one or more breaks in various portions of the rounded margin. It is in the direction of these that the ulcer has a tendency to spread. The true margins of this ulceration are always surrounded by an area of infiltration more or less dense, and as the ulcer spreads over the surface of the cornea, the infiltrated edges slough off and form part of the central excavation.

In the majority of cases it is the *center of the cornea* that is first affected or, in any event, the ulcer creeps in that direction. *Hypopyon is usually present* and the anterior chamber may become almost filled with pus. This process may go on until the whole cornea has become involved, leaving an opacity the density of which depends upon the severity of the disease.



In many cases the normal cornea is replaced by a dense white cicatrix (*leucoma*); in other cases the corneal tissue becomes softened and bulges (*staphyloma*) from the intraocular pressure. *Vision is very much interfered with.* Perforation is much less likely to take place than in deep ulcer. In some severe cases the whole cornea sloughs, followed by destruction of the globe from panophthalmitis.

When repair begins the surface becomes vascular and further extension of the ulcer is checked. The general health is usually affected in serpiginous ulcer.

*Treatment.*—This is much the same as in deep ulcer—atropia, hot fomentations, some effective cautery and antiseptic collyria. In addition to these, tonics (especially the tincture of the chloride of iron in large doses with small doses of quinin) and regulation of the diet are called for. *The spreading of the ulcer must be checked by cauterizing its surface and undermined margins.* The actual cautery, especially the *galvano-cautery*, seems to be the best means of arresting the disease in most cases. In the milder forms of the disease the pure tincture of iodine (q. v.) has a beneficial effect. *Pure carbolic acid*, 10 per cent. solution of *nitric acid* (q. v.), *iodized phenol*, 1 in 20 of *formalin*, or one per cent. solution of *sublimite in alcohol*, have also been used with good results.

*A wooden tooth-pick is dipped in any of these remedies and applied thoroughly to the cocainized ulcer-excavation, after cleansing and staining with fluorescein. To be effective the tooth-pick should be soaked in the germicide fluid and pricked into the surface of the ulcer.*

Edward Jackson (p. c.) believes *nitric acid* to be a valuable *caustic* for corneal ulcers *surrounded by limited infiltration*, as those infected by a foreign body, recurring marginal ulcers, *Mooren's ulcer* (q. v.), and acute, creeping, superficial ulcers. First use a local anesthetic, preferably holocain. Place a drop of pure nitric acid upon a surface of glass. Take a toothpick of hard, smooth wood, and see that the point is small enough for convenient use within the ulcer, free from splinters and smooth. Dip this point in the acid and wait until the minute drop adhering to it has been entirely absorbed into the wood; so that there remains no shine, and the wood becomes somewhat discolored. Then press the point against each part of the surface to be cauterized. It produces an immediate whitening, by coagulation of the tissue and exudate. This whitened area does not extend after the contact ceases. When the point of wood no longer produces such an effect on the surface touched, it may be once more dipped into the acid; and allowed to again absorb all acid

from its surface before continuing the application. Such an application is often followed by pain which may be controlled by instillations of solutions of holocain. When the exudation is thick or there is much damaged tissue this should be curetted away before applying nitric acid.

In *serpent ulcer* H. W. Woodruff (p. c.) strongly recommends *subconjunctival injections of mercuric cyanide*, after the method of Bourgeois: The conjunctiva is anesthetized by three or four instillations of 4 per cent. cocaine solution during ten or fifteen minutes. Then *eight minims of a solution of cyanide of mercury, 1 to 1,000, with four minims of 4 per cent. cocaine added, are injected beneath the external conjunctival cul-de-sac with the hypodermic syringe*. When the needle comes in contact with the external wall of the orbit the point should be turned slightly inward and the needle plunged deeply into the tissues, so that the *injection is more than sub-conjunctival*. The tissues of the orbit surrounding the eyeball are bathed with this solution. The swelling and edema which follow are quite severe, but this is probably beneficial rather than harmful. He has used these injections in 30 cases with signal success.

*Incision through the floor of the ulcer* should be resorted to if there is danger of perforation; sometimes paracentesis greatly assists the healing of the ulcer.

Hesse\* treats (Bier's hyperemia method) all cases of *serpent ulcer of the cornea, without exception, with suction by means of glass cups applied over the opened lids*, twice daily for 10 to 30 minutes, with short intermissions after each 10 minutes. The application is not painful and it relieves the frequently violent pain at once. Only in 3 cases out of 23, the clinical histories of which are reported in detail, did the treatment fail. These 3 were complicated by dacryocysto-blennorrhea, from which reinfections took place. *In such cases conservative treatment must be abandoned and the tear sac extirpated*. In the remaining 18 cases the effect of suction was favorable. The average duration was about 11 days. All other medication was excluded, except atropin twice daily. The resulting scars were very clean and thin, interfering less with vision. Hesse recommends passive congestion by suction in connection with other methods of treatment.

Gallemaerts\*\* (*Amer. Journal of Ophthalmology*, January, 1908). gives some interesting data regarding the bacteriology of *serpiginous ulcers of the cornea* and the treatments depending on the infection.

\* Hesse. *Centralbl. f. pkt. Augenheilk*, May, 1907.

\*\*Review of the translation in *Annals of Ophthalmology*, Oct., 1908.

He cites thirty-nine cases, the microbes being the staphylococcus pyogenes aureus, Morax-Axenfeld diplobacillus pneumococcus and the streptococcus. The staphylococcus was present in only one case in conjunction with an abundant secretion.

The *corneal diplobacillus ulcer* (Morax-Axenfeld) he found to be fairly common, observing twenty severe cases in one year, with only four of these cases giving a history of trauma. In a certain number of these cases the keratitis was only a small, limited marginal ulcer; in others there was a decided tendency to spread, the ulcer being irregular, with ramifications and not infrequently hypopyon and iritis, and smaller ulcers around the principal focus.

The treatment advised for this form of infection is zinc sulphate, washing the conjunctiva with a 1 per cent. solution three times daily, and once a day cauterizing the ulcer with a cotton pledget soaked in a 1 to 40 solution; a bandage being applied till the epithelium is reformed. In none of the cases did the author find it necessary to perform a paracentesis or to employ the galvanocautery.

As the *sulphate of zinc*, when brought in contact with cultures of the diplobacillus, does not kill them or even arrest their growth until after several days, the author cannot explain the results obtained unless the sulphate of zinc enhances the bactericidal qualities of the conjunctival secretions in some peculiar way. In this case the diplobacilli, which as Stock's microscopical researches show, live on the surface, are rapidly destroyed.

The *pneumococcus infections of the cornea* and conjunctiva he describes as the Fraenkel-Weichselbaum diplococcus, which, contrary to the diplobacillus, penetrates deeply into the corneal lamellæ, and is found not in the superficial layers of the ulcer but among the leucocytes in the whitish ring which surrounds the ulcer.

Fourteen of these cases were treated in one year, eight of them with *Roemer's serum*. Ten of the fourteen gave a history of trauma, and in all but two cases hypopyon was present, in two a dacryocystitis.

His results with Roemer's serum, which is a polyvalent bactericide, are especially interesting owing to the conflicting opinions regarding its usefulness.

He decides from the clinical picture which ulcers need serum and which do not. The latter show less reaction; the grayish white ring surrounding the ulcer is barely visible, and the infiltration instead of being spread widely is more limited. The former are surrounded by a white zone with small disseminated foci and are associated with marked hypopyon.

Of the mild forms some were treated by scraping the ulcer and cauterizing with *iodine in essence of juniper 5 per cent.*; others with galvano-cautery, and others, more severe, by the Saemisch operation and paracentesis of the anterior chamber.

In eight cases, after the old methods had given no results, or had failed to stop the progress of the ulcer, Roemer's serum was used. With one injection of 10 cc. the change was marked; the pain disappeared, the hypopyon decreased, and the ulcer was arrested.

From these clinical facts he believes that there are several varieties of pneumococci as regards their virulence, and cites Roemer's experiments which show that the virulence varies in the enormous proportions of from 1:40 to 1:150,000.

In conclusion, Gallemaerts states that he believes it to be our duty to make a bacteriological analysis of all corneal ulcers and to base the treatment on the results; also that the term *serpiginous ulcer* can no longer be reserved alone for pneumococcus ulcer, since different microbes, especially diplobacilli, can cause it. The term should always be completed by the designation of the microbic species which causes the keratitis.

#### Ring Ulcer.

##### *Annular ulcer.*

This form of the disease is situated at and tends to spread about the margin of the cornea. It is generally seen in elderly people, especially in those who have a *chronic catarrh of the palpebral conjunctiva* or a *chronic dacryocystitis*. It probably arises from an abrasion of the epithelium due to the lodgment of a foreign body at the corneal limbus, infection taking place from the conjunctival or other discharge present. A common form of this disease occurs in farmers, whose eyes are liable to injury from the flying stems and other parts of wheat or hay. An abrasion of the cornea is the result and infection follows.

It usually takes the form of a *deep ulcer with infiltrated edges*, that spreads along the corneal margin instead of extending towards the pupil as in ordinary serpiginous ulcer. The older ulcer may heal while the recent necrosis gradually extends, although destruction of the whole cornea may occur from interference with its nutrition, especially if the ulcer has already eaten completely around the sclero-corneal junction.

*Treatment* should be carried on actively, with atropin, mild antiseptic solutions and hot applications. The general health should be built up by the internal administration of iron, quinin, etc., and a nutritious diet. If there is *danger of perforation* a solution of *eserin*,  $\frac{1}{4}$  to  $\frac{1}{2}$  per cent., may be instilled into the conjunctival sac in order to

contract the pupil and render prolapse of the iris less likely. In such a case paracentesis through the floor of the ulcer should be performed without delay. The early and thorough employment by the *actual cautery* is here indicated and it should be repeated if necessary.

**Marginal Ulcer.**

This rare form of superficial ulceration of the cornea, described by zur Nedden, and said by him to be due to a specific organism, usually recovers under local disinfectants and the cautery, actual or chemical. Tincture of iodine or iodine-phenol (q. v.) makes an acceptable application.

## CHAPTER XXXIX.

### TREATMENT OF DISEASES OF THE CORNEA, CONCLUDED.

*Treatment of Dendritic Ulcer—Corneal Abscess—Fistula of the Cornea—Opacities of the Cornea—Keratitis in General—Interstitial Keratitis—Herpes Zoster Ophthalmicus Corneae—Catarrhal Herpes of the Cornea—Superficial Punctate Keratitis—Punctate Keratitis—Phlyctenular Keratitis—Mycotic Keratitis—Aspergillus Keratitis—Xerotic Keratitis—Vascular Keratitis—Pannus—Keratitis Disciformis—Filamentary Keratitis—Marginal Keratitis—Grill-like Keratitis—Neuroparalytic Keratitis—Keratitis Bullosa—Keratitis Profunda—Injuries to the Cornea—Conical Cornea—Tattooing the Cornea—Corneal Tuberculosis.*

#### Dendritic Ulcer or Keratitis.

*Malarial keratitis. Mycotic keratitis. Furrow-keratitis.*

This superficial form of corneal infection is characterized by small, branching, furrow-like ulcers that do not penetrate deeper than Bowman's layer. Although all cases are not of malarial origin the *plasmodium* can be found in the majority.

Protection of the eye from light, wind and dust and instillation of a holocain and atropine solution (1 per cent. each) are the most important points in the therapy. In addition all the minute furrows should be *cur- etted* under holocain and cocain and the eye thoroughly disinfected with White's ointment, preceded by flushing the sac with 1-2000 of permanganate of potash or bichloride of mercury. The subsequent massage with iodine-vasogen (5 per cent.) will facilitate a cure. Of course the *general treatment* is also of great importance.

Darier (*Thérapeutique Oculaire*, p. 321) gives as a synonym *arthritic ulcer of the cornea* because he believes that it mostly occurs in elderly rheumatic subjects. He warns us against using irritating remedies in these cases. The general condition must be treated by aspirin (in 30 to 40 grain doses daily), *benzoate of sodium* or the *salts of lithium* prescribed in full doses. If these are insufficient colchicin (q. v.) should be carefully administered. If much pain is present he recommends the following collyrium, of which one drop is to be instilled into the eye from 4 to 6 times a day:

R

Dionin.

Cocain. hydrochlor.

āā 0.10

Sodii bicarb.	0.20
Aquæ dest.	10.00

### Corneal Abscess.

(*Onyx*). It is an occasional result of infective ulcer: and usually associated with the *serpent, creeping or spreading variety*, while hypopyon and iritis are almost invariably present. It is attended by severe pain, photophobia and blepharospasm, with much circumcorneal injection and tenderness. An abscess situated in the deeper layers of the cornea (*onyx*) is, strange to say, less likely to result in ulceration than a more superficial abscess, while absorption of its contents occasionally takes place.

*Treatment*.—Atropin and hot applications should be used, but if the abscess shows a tendency to spread or to go on to ulceration, treatment of a more active nature should be substituted. *An incision should be made into the abscess cavity and its walls thoroughly scraped or cauterized (or both procedures adopted) and treated as a sloughing ulcer.*

In addition to the operative treatment irrigations with 1-10000 of hot formalin solution will be found of considerable value.

### Fistula of the Cornea.

#### *Fistulous staphyloma.*

It is not a common lesion and its treatment is mostly operative. Among the non-operative measures that have from time to time been suggested, Zehender proposed the application of a *compress, the instillation of eserine and rest in bed*. The subjects of fistulous ulcers of the cornea are liable to have an infective iridocyclitis with ultimate atrophy or loss of the eye. Of course should this set in, it will have to be treated *secundum artem*.

In the drug treatment of fistula corneæ pilocarpin or arecolin (q. v.) should be used instead of eserine if that drug proves too irritating. Both the arecolin and pilocarpin should be instilled as a  $\frac{1}{2}$  to one per cent. solution and used two or three times a day.

### Opacities of the Cornea.

These have already been referred to as a frequent result of disease, *usually ulcer*, of that organ. Generally speaking, one has to deal with corneal *scars*, more or less thick or extensive, but *they may be due to exudates into the corneal substance*. A *faint opacity*, requiring the oblique illumination to see it distinctly, is called a *nebula*; a *macula* is a more distinct opacity, while a *leucoma* is a dense, white cicatrix, readily seen even at a distance from the patient. When, as a result of a perforating ulcer, the iris is attached to the healed scar tissue we have a *leucoma adherens*. Even a *nebula, if it occupy the area of the*



*pupil*, reduces the vision considerably; *blindness*, as well as marked *disfigurement*, results from a central leucoma.

*Treatment*.—When the opacity is due to an exudate into the corneal tissue, or to a *faint* and recent cicatrix (*especially in children*) it may be removed entirely, or much reduced in density, by appropriate treatment. The most effective remedy is *massage with some stimulating ointment*, preferably the “brown salve,” described elsewhere. *Irritants*, like oil of turpentine, iodine-vasogen, (q. v.), calomel or tincture of opium, stimulate absorption of corneal deposits and may be used, once every day, with the massage. The Roentgen rays have also been recently used with considerable success. Old scars, especially in adults, are not much influenced by any form of treatment.

Thiosinamine (q. v.) in doses of 1 to 5 grains three times daily, or *fibrolysin* (q. v.) in the hypodermic or subconjunctival form, has many advocates.

The success following the use of *thiosinamine* in softening and *dissolving scar tissue* led to its employment in similar conditions about the eye, as in lid scars, in *corneal maculae*, symblepharon, extensive pterygium, etc. Many favorable reports have been published on this subject. For example, K. H. Grunert (58) found thiosinamine of use in lupoid scars of the skin and in post-neuritic atrophy. In the former case, the author used a solution of 4 grm. (gr. 60) of thiosinamine in 8 grm. (gr. 120) of glycerine and 40 grm. (oz. 1 1-3) of water; in the latter case, the same solution with the addition of 0.2 grm (gr. 3) of strychnine nitrate. Of this 1 cc. (m 16) was injected into the muscles, at first daily, then at gradually increasing intervals. The remedy acts by softening and diminishing post-neuritic connective tissue formations in the optic nerves. The addition of strychnine is only needed at the beginning of the treatment, for when once the improvement has come to a standstill, the improved condition may be maintained by means of thiosinamine alone. The author's statement that the condition invariably grows worse if the treatment be left off too soon is of some importance.

The results obtained by D. Bruno (59) by the use of *fibrolysin* (q. v.) in eye diseases are worthy of note. It acts beneficially in softening scar tissue in leucomata after the subsidence of keratitis with hypopyon. Well-marked leucomata, which seriously interfered with vision, he reduced to slight nebulae by injections of fibrolysin into the glutei, or into the back. These injections were found to be equally efficacious in cicatricial spots resulting from syphilitic iritis, and exudative chorioiditis. In many cases they were useful in softening and loosening the scar tissue, and thus facilitating further treatment.

Suker has also published favorable reports on the use of thiosinamine in corneal scars, but I have not been able to obtain as marked benefits from its employment. He says that the cases in which thiosinamine is indicated are:

1. Corneal opacities from any cause whatsoever.
2. Cicatricial contractions of the lids following trachoma.
3. Certain intra-ocular inflammations, as exudative choroiditis.
4. Symblepharon.
5. Capsular opacities following cataract extractons (experimental).
6. Ectropion, especially cicatricial.
7. Plastic iritis.

Speaking of the mode of administration he remarks that opinions differ widely: "Some, like Black, Newton and others, prefer the hypodermatic injections, two or three times a week. Again others, as Tousey, Ruoff and Beck, give preference to the administration by the mouth. The weight of experience is in favor of three-grain capsules once or twice a day. The hypodermatic injections are not very desirable, as the solution does not keep overly well. Not only that, but abscesses are prone to follow; this has been the writer's experience. For topical applications, a 10 per cent. ointment is the most efficient. The latter can be applied two or three times a day in conjunction with massage of the part."

"The idea of employing subconjunctival injections of thiosinamine for corneal opacities occurred to the writer but a short time ago. The fact that it is used locally for keloids led to the experiment. A 10 per cent aqueous, glycerinated solution was used. Of this 15 minims were injected three times a week after thoroughly cocainizing the eye. The injections are not painful, nor do they cause any great inconvenience."

J. L. Duncan (p. c.) has had excellent results from 1 grain doses of *thiosinamine* (in capsules) three times a day in both *old and new corneal opacities*.

Galezowski (*Receueil d'Ophtalmologie*, June, 1908) has used *thiosinamine* in solutions of 5 per cent. to 15 per cent. for corneal *nebulae* with very satisfactory results. These solutions are used in an eyebath and are well borne as a rule. Should they give rise to a little redness of the eye, after a few days' application, they must be discontinued for some days, and if their application causes pain a few drops of cocain may be instilled beforehand. The baths are used once or twice a day for about five minutes at a time. In the case of children the same solutions are used in the form of drops.

Galezowski's results in 26 cases were as follows: 9, very marked improvement; 11, appreciable improvement; 6, no change. In the course of some weeks the leucoma can be seen to be less white and less visible, and although it does not disappear altogether, it soon allows of the easier transmission of light.

Windmüller (*Medizinische Klinik*, March 1, 1908; *Ophthalmology Abstract*) having failed to influence an opacity of the cornea by intramuscular injections of *fibrolysin*, tried the *local application* of this product. He has employed fibrolysin in this way in the treatment of various affections of the eye. The best results have been obtained in *corneal opacities*, whether of inflammatory or non-inflammatory origin. The remedy should not be used until all active signs have disappeared. The fibrolysin is applied *one to three times a day*, the absorbent powers of the eye having been reinforced by the application of dionin (2 to 10 per cent., gradually increased).

Slight stinging pain is the immediate result of the application, but rapid blinking speedily removes any discomfort. Fibrolysin, in Windmüller's experience, causes a disappearance or a reduction of the corneal opacity, and in some cases, an improvement in sight. The æsthetic gain is sometimes very marked. The fibrolysin should always be used fresh.

J. A. Andrews (p. c.) employs *iodine-vasogen* (q. v.) in 5 to 10 per cent. solution, making the application on a cotton-tipped probe, every other day until the infiltration shows signs of shrinking; then, according to indications it may be applied every third day. Sometimes this remedy *causes decided pain* even in milder solutions. For this reason Andrews prepares the eye by washing it with a normal salt solution, afterwards instilling a 2 per cent. solution of *alypin*. Before applying the iodine-vasogen, the excess of tears should be carefully wiped from the eye with cotton.

Homer E. Smith (p. c.) has had brilliant results, *even in corneal leucomata*, from the use of dionin with atropin, but he also employs as an adjunct, *hypodermically*, 15-30 minims *every other day* of the following:

℞

Thiosinamin.

Antipyrin.

Aquæ dest.

āā gr. xv

fl. ʒi

*Turpentine* is also employed in local applications to the eye as a *stimulant to absorption of corneal opacities*. Königstein dilutes it one-half with almond oil for this purpose. A single drop is instilled

into the eye which is then covered by a protective and the ensuing hyperemia watched. Undue irritation should be avoided, especially as the treatment may have to be continued for several weeks.

J. M. Woodson, (p. c.) has had excellent results in the treatment of *corneal opacities* from the local use of *dionin in the form of powder*. He has noticed that the improvement continues as long as the drug produces irritation of the cornea and conjunctiva.

Guillery and zur Nedden\* advise the employment of 5 to 10 per cent. solutions of *ammonium bitartrate*, neutralized by the addition of liquor ammoniæ, in removing *opacities of the cornea produced by lime burns*. The solution is applied in an eye-cup three times daily. A little cocaine may be used in conjunction with the treatment, although the pain is not severe. To be effective the treatment must be applied early before the deposits take on the form of the carbonate.

Sulzer\*\* discusses the effect produced upon opacities of the cornea by *electrolysis, phototherapy, and radiotherapy*.

*Electrolysis*.—"After the eye has been cleansed, and rendered anesthetic by cocaine, the lids are separated by means of a speculum. The negative electrode consists of a bit of silver wire, 1.5 mm. in diameter, the end of which has been fused in a Bunsen flame, so that it forms a smaller or larger bead. The positive electrode, which is applied to the nape of the neck, is formed of a zinc *plaque*, enveloped in moistened wash-leather. When the silver electrode is applied to the cornea, a fine foam forms, and by a longer exposure, the nebula is raised by small bubbles, 0.3 mm. or so in diameter, which are produced between the cornea proper and the opacity. The electrodes are in communication with a table containing the resistances and measuring instruments, supplied by accumulators giving a current of 110 volts. During the application the voltmeter should register four to six volts. According to Sulzer, the results obtained from the electrolysis of *nebulæ* are good. The look of eyes presenting superficial white cicatrices is always improved. The bettering of sight, however, is not so pronounced. At the same time, acuities below 1-10 may be raised to 2-10 or 3-10, while acuities of 0.2 to 0.4 have been improved 1-10 or 2-10. Six cases are quoted by the author in support of his conclusions.

*Phototherapy*.—The source of light is the arc lamp of Broca-Chatain, which is rich in characteristic radiations. A quartz lens, hav-

\**Archives of Ophthalmology*, Sept., 1907.

\*\**Annales d'oculistique*, Nov., 1906; reviewed in the *Ophthalmoscope*, Jan., 1907.

ing a diameter of 40 mm. and a principal focal distance of 50 mm., is placed at a distance of 100 mm. from the lamp, and provided with a diaphragm. The eye is placed at the conjugate focus of the arc formed by the quartz lens. In order to diminish the intensity of light as much as possible, the pupil is contracted by means of physostigmine or pilocarpine. Cocaine is also applied to the eye, the lids of which, if necessary, are held apart by an assistant or by a speculum. The time of exposure is from 20 to 90 seconds. The minimum exposure must first be adopted, but when the reactional susceptibility of the patient has been determined, the duration of the sittings may be prolonged. Successive exposures are made at intervals of from one week to two weeks. Their number varies from four to twenty in individual cases. Sulzer is of opinion that short exposures at comparatively short intervals are preferable to longer exposures given less frequently. After exposure to actinic rays, reaction occurs, which is proportional to the length of exposure. This appears at a time that varies from two hours to two days after the treatment, and manifests itself by redness of the eye, lachrymation, and lancinating pains. On examining the eye during this phase with focal illumination, one observes a slight and uniform dullness of the cornea, together with ciliary redness, but these appearances vanish in the course of a few hours or of three days at the most. Employed after electrolysis in superficial and clearly defined nebulæ, or by itself in cases of sclerosis, phototherapy may cause a considerable improvement in sight. Sulzer makes the important observation that under the influence of the light treatment, tension falls, pupillary exudations become absorbed rapidly, and that posterior synechia undergo rupture. Nineteen cases are quoted in support of the author's conclusions.

*Radiotherapy.*—No particular reaction followed the exposure of sclerosed corneæ for a period of eight minutes to the rays emitted from the anticathode of a radiogenic tube, which gave out  $\frac{1}{2}$  H. per minute. The same exposure, however, produced a violent and salutary reaction in a case of trachoma. During the two or three weeks following the application of the X-rays a slow but sensible clearing was observed in the sclerotic corneæ. Radiotherapy, according to Sulzer, produces curative effects analogous to those obtained by the light treatment, although they are more feeble and slower. On the other hand, they have the advantage of being associated with neither reaction nor pain.

From his experiments Sulzer concludes that physical agencies are able to improve the sight of those affected with opacities of the cornea. The best application for this purpose is electrolysis combined with

phototherapy for corneal opacities or phototherapy alone for sclerosis, such as follows interstitial keratitis. In timid subjects, phototherapy may be replaced by radiotherapy."

Pick\* prescribes a *solution of ammonium chloride* (q. v.) as a means of clearing up corneal opacities. The application is contraindicated in recent opacities and if the eye be congested he uses one to three teaspoonfuls of the chloride in a cupful of boiled water, the liquid being applied three or four times a day by means of an eye-cup.

#### **Ribbon-shaped Corneal Opacity.**

F. C. Heath (*Jour. Am. Med. Ass'n.*, July 18, 1908,) in discussing the condition variously described as calcareous film, *band opacity* (Graefe) and *ribbon-shaped keratitis*, remarks that it may be primary or occur in eyes blind from glaucoma or iridocyclitis. The opacities are punctiform and crowded together, forming a gray stripe across the cornea, occupying the exposed portion of the lid fissure. The disease progresses slowly and sooner or later both eyes are involved. In some cases there are attacks of severe pain, but ulceration is never observed. Most cases occur in men over 45. The pathological condition is a hyaline degeneration of corneal cells that later become calcareous. Gout, renal disorders, loss of vital energy in the cornea through vascular changes, repeated irritation of the surface of the eye, as by foreign bodies, are etiologic factors. Graefe noted a resemblance to glaucoma and bad effects of atropin. Sight has been improved by scraping the cornea and by iridectomy. *Carbonate of soda, nitric acid, hydrochloric acid, 5 per cent.*, have been recommended. In Heath's case, *scraping and applications of weak carbonate of soda solutions* were of no avail. Iridectomy resulted in vision of 15/1x, since when the patient had been able to get about alone.

#### **Keratitis in General.**

Radcliffe (p. c.) has advocated in a recent paper the use of *thyroid extract in the various forms of keratitis*, commencing with a small dose, *one or two grains three times daily*, watching carefully the constitutional effect. He believes it to be of great advantage to use it early and even in cases where other drugs are properly indicated. While the physiological action of thyroid is not fully understood, he believes it has a dual action; first, on the lymphatic system and, secondly, in increasing metabolism and nutrition. It undoubtedly increases the lymphatic action as a marked improvement was seen in his cases within the

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\**Centralbl. f. prak. Augenheilk.*, June, 1906.



first four days after beginning its use. Such rapid improvement would hardly be the result of an improved nutrition alone.

Frenkel,\* following the example of the Tersons, has used subconjunctival *injections of air* largely in the treatment of *various diseases of the cornea*. He gives a table showing the results obtained in 51 carefully noted cases which had previously been unsuccessfully treated by the ordinary methods for periods varying from three days to six months. These were satisfactory in eight cases of phlyctenular keratoconjunctivitis, one case of fascicular keratitis, seven cases of corneal abscess (five healing rapidly and two slowly), six out of seven cases of central corneal ulcer, four out of seven cases of marginal corneal ulcer, and seven cases of corneal ulcer with pannus. In four cases of hypopyon ulcer, three cases of interstitial keratitis, and one case of syphilitic scleritis, the improvement was less marked, although the treatment appeared to have a favorable influence on the diseases.

Frenkel suggests that their therapeutic action is due largely to 1. relief of pain from (a) stretching, or (b) compression of the terminal filaments of the fifth nerve; 2. stimulation of the leucocytes by the oxygen; 3. stimulation of trophic nerve fibres. Finally, Frenkel is of opinion that in competent hands subconjunctival injections of air are harmless, and owing to simplicity of *technique*, are likely to be largely used, that they are most valuable in superficial affections of the anterior segment of the eye, that their action is symptomatic rather than specific, and requires to be supplemented by other therapeutic measures, that they are especially efficacious in relieving pain, and, lastly, that they should be regarded as intermediate in intensity between mercurial ointments and injections of saline solution or cyanide of mercury. He recommends that the injections should be given every three days, and that if the desired effect is not produced in a fortnight, the treatment should be altered.

Bliss\*\* believes the age and physical condition of a patient determines largely the susceptibility to *bacterial infection of the cornea*. Secondary nutritive changes, often due to arteriosclerosis in persons old beyond their years, accounts for many infections following surgical operations. The writer uses protargol, and later nitrate of silver, for the most serious corneal infections. For external application he depends largely on chloride of ammonium in solution, hot or cold, spirits of camphor, and *steam*. He uses camphor diluted almost to precipitation

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\**Annales d'oculistique*, March, 1908. Review in the *Ophthalmoscope*, July, 1908.

\*\**Ophthalmology*, July, 1908.



on a pad of cloth fastened to a pasteboard shield; this need not touch the lid, and the eye can be opened under the shield. He says the vapor is cooling and very agreeable to the eye, and relieves pain. Steam is used at a temperature that can be borne directly on the eye from five to ten minutes at a time, and gives great relief from pain. When the general physical condition is low he has found quinin in fairly large doses very valuable.

### **Interstitial Keratitis.**

*Parenchymatous keratitis. Specific or strumous keratitis. Keratitis profunda. Diffuse keratitis.*

Interstitial keratitis is, in the majority of instances, a *hereditary disease*, of *syphilitic* origin, although some cases are probably evidence of a *tubercular* or *scrofulous taint*. It usually occurs in children and young adults, girls being affected more commonly than boys. The patient shows other signs of hereditary syphilis or congenital struma, as seen, for example, in the flattened nose, the scars around the corners of the mouth, absence of the labio-nasal folds, and the "*pegged*" *teeth* described by Jonathan Hutchinson. The exudate is quite rare as a late manifestation of acquired syphilis. In some cases no cause can be assigned for its origin.

The disease commences with a faint opacity near the limbus, which gradually extends towards the center of the cornea, often clearing up from the margin as the central portion is involved. The deposit is evidently in the deep layers of the cornea and is practically never accompanied by loss of the protecting epithelium. It is a corneal exudate and has nothing to do with ulcer.

The whole cornea is eventually covered with a more or less dense, smooth and irregular opacity which may be so pronounced as to render the iris and pupil invisible. Vascularization of the deep layers of the cornea takes place and in some instances is so marked as to give areas of greater or less extent a pinkish or yellowish hue. There are known as "*salmon patches*." These new vessels, running in uniform, parallel rows, are derived from the deep conjunctival vessels and while in some cases are only recognized under oblique illumination or with a corneal loup, at others are clearly defined and can be recognized without difficulty. The empty tubes of the vessels can, years afterward, be distinguished with a dilated pupil, good illumination and the corneal loup (when no other corneal sign of the disease remains) as branched lines running in the deep layers of the cornea. They are known, from the observer who first described them, as "*Hirschberg's vessels*."

The *opaque exudates* may be absorbed completely in a few weeks

or months, or they may remain (especially over the pupillary area) for a much longer time, with more or less permanent impairment of vision. Sometimes the center of the cornea is first involved, the opacity extending towards the margin and the clearing gradually taking place from the center towards the margin. As a rule, there is *but slight photophobia and lachrymation*, not even accompanying marked injection of the region surrounding the margin of the cornea. When there is much pain, tenderness, photophobia and pericorneal injection, iritis or choroiditis (or both) may be suspected—in fact vision may be permanently damaged or even practically destroyed from an inflammation of the internal structures of the eyeball.

*Both eyes are usually attacked*—rarely both at one time. Indeed, the one first attacked is frequently well before a like process begins in the other. Relapses are not infrequent; the opacity may almost entirely disappear when a fresh attack develops that may be even more severe than the first. The disease commonly extends over many months, the acute stage lasting at least several weeks; then the opacity becomes so dense that the patient is practically blind, and walks about with great difficulty. Although the corneal opacity may never entirely disappear (haziness of the cornea remaining) *the patient may be told that the densest opacity will ultimately clear up enough for useful vision, provided always that the internal structures of the eye have not been permanently damaged.* Posterior synechiæ may follow here as elsewhere from an iritis, while patches of atrophy in the choroid and opacities in the vitreous may result from the specific choroiditis.

Interstitial keratitis of non-syphilitic origin is usually less vascular and the opacity is apt to be less diffuse.

*Treatment.*—During the acute stages instillation of a 1 per cent. solution of atropin should be made sufficiently often to keep the pupil dilated, while hot applications of chamomile tea, boric acid solution, etc., every one to three hours, should be kept up as long as signs of capillary congestion are present. After the subsidence of the acute symptoms massage of the cornea with yellow oxide of mercury ointment, or the nitrate of mercury ointment with cod liver oil (q. v.) should be systematically carried out for the purpose of hastening absorption of the opacity.

*The patient's general health always requires attention.* The alimentary canal should be regulated with small doses of calomel, gr. 1/10 to 1/4 given frequently until the bowels are acted upon. This should be followed by tonics in the form of tincture of iron, syrup of the iodide of iron, cod liver oil, etc. Even the purely syphilitic cases are not helped by the so-called anti-syphilitic remedies as much as by

the agents just mentioned. It must be remembered that some of these cases are *tubercular* and treatment proper to that infection should be given.

The patient should be given a nutritious diet, with plenty of milk and eggs, avoiding pastry, sweets and too much meat. The efficacy of outdoor *exercise and sleep* in the fresh air should be insisted upon.

*Subconjunctival injections* (q. v.) have been found useful by many observers and the corneal opacities or exudates that remain after the acute symptoms have subsided are probably best reached in this way than by any other means of treatment.

Risley, Sr. (*Oph. Record*, July, 1908), believes that a considerable group of affections which may be designated diseases of nutrition are frequently responsible for this form of corneal disease. Where inherited syphilis can be traced in the second and third generations it is often only one of the incidental manifestations of the faulty general metabolism. Two cases are reported of profound interstitial keratitis without specific history, or other specific manifestations. The general conditions were more those of myxedema; general torpor of mind and body; skin appearance of old ivory; general dropsical appearance, but with hardness of the flesh, without pitting, and no albuminuria; stubby clubbed fingers and stunted growth; dry skin, thick dry lips, swollen tongue and palate. No improvement in the ocular or physical condition was manifested until the administration was begun of the *dried pulv. thyroid gland* (q. v.) of the sheep, gr. iii, t. i. d. The local corneal improvement was astonishing, as was also the physical improvement. Recovery took place in each case, but in one there was some years later an attack of interstitial keratitis in the fellow eye which was not involved in the first attack. It occurred under quite different physical conditions, and the administration of the thyroid did no good. He recovered, however, under mercurial treatment.

Wray\* treated 9 cases of *interstitial keratitis* by *acetozone* (3 to 5 grains in capsules 3 times daily) with excellent results. He claims that the results in all forms of iritis are admirable, and equally so in interstitial keratitis, when seen within a week or so of the commencement of the disease. In the latter two or three days at times suffice to remove the corneal opacity, and nothing remains but a little keratitis punctata. There is no reason why the treatment should not be combined with inunction, but in nearly all the cases treated by acetozone, mercury had been tried for at least six weeks, and in some cases for several months. The only objection to acetozone is the price, and this

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\**Medicine*, Oct., 1906.

is a consideration if the drug has to be used for several weeks. The drug treatment is combined with hydropathy—mainly water drinking and outdoor exercise.

Proof<sup>1</sup> is forthcoming to show that pure oxycyanide of mercury possesses the bactericidal properties which are expected of it by those who prescribe it. Recent reports by G. Hirsch\*\* show that "Injection Hirsch" consists of a 1 p. c. solution of oxycyanide of mercury with the addition of 0.4 p. c. of acoin. More acoin is not only unnecessary for obtaining complete immunity from pain, but is undesirable, because of the ease with which it separates out of its solution. As the result of his trials of this solution in syphilis, the author adheres to his method of commencing with injections of 1 c. c. (m 16) in adults, and increasing to 1.5 c. c. (m 24) per diem after the first few injections have proved to be well borne. With this treatment he cured, among other cases, children with *interstitial keratitis due to hereditary syphilis*. Hirsch begins in these cases with 0.5 c. c. (m 8) and increases gradually to 1 c. c. (m 15). In obstinate cases particularly, this treatment was found superior to the usual inunction methods. It led to a rapid cure, without producing secondary actions.

Terlinck (ref. *Zeitschrift f. Augenheilk.*, Dec., 1907) found parenchymatous keratitis to be decidedly improved by large *hypodermic injections of iodine preparations*. He prefers *lipiodol* (which contains 40 per cent. of pure iodine) and gives of it at least 20 daily injections. The iodine in this compound very slowly dissolves.

Webster Fox (*Text-book*, p. 147) injects subconjunctivally 10-20 cc of the following solution:

℞	
Sodii saccharat.	gr. xv
Aquæ dest.	fl. ʒi

He says that this has given better results in interstitial keratitis than the normal salt solution; it is less painful in the same strength, when used either at the time of the injection or subsequently.

The distension of the conjunctiva usually disappears in three hours and no untoward symptoms follow. After the injection the following antiphlogistic lotion is applied to the eye to reduce the swelling:

℞	
Liquor. plumbi subacetatis dil.	fl. ʒij
Tinct. opii.	

<sup>1</sup>See Merck's *Annual Reports*, 1906, p. 147.

\*\**Medizinische Klinik*, 1907. No. 25, p. 737.

Tinct. belladonna	āā fl. ʒiss.
Tinct. arnicæ	fl. ʒj
Aquæ camph.	
Aquæ dest.	āā fl. ʒiss.

Both Pflueger and Cohn observed much benefit from the use of *hetol* (q. v.) in *parenchymatous keratitis*. The latter used it in the form of collyrium—a one per cent. solution—to which he added the same quantity of cocaine to minimize the pain. He believed that it exerts a favorable effect on the disease both in its acute and chronic phases.

#### **Herpes Zoster Ophthalmicus Corneæ.**

Herpetic ulcer is the result of herpes zoster of the ophthalmic division of the fifth nerve, which is often seen with herpes of the face, lips and nose. Small vesicles occasionally form on the cornea; these, breaking down, are infected and eventually produce ulceration. The disease is accompanied by severe pain of a neuralgic character. The resulting corneal opacities often interfere with useful vision.

*Treatment.*—Should be constitutional as well as local. As a rule a mixture of *holocaine* (not cocaine) and atropine will be found to act very satisfactorily. The local lesions should be carefully touched with tincture of iodine, phenol, (q. v.) or, as Webster Fox suggests, a 10 per cent. solution of trichloroacetic acid. He also suggests that the eye be irrigated with a solution containing hydrastin, boric acid or a 1:500 sublimate solution, and that when pain is present one drop of the following mixture, instilled into the eye every half hour, gives relief:

R	
Olei ricini.	fl. ʒiii
Olei rosæ	gtt. i

Constitutional treatment should not be neglected in cases of this description; a thorough examination should be made and any indication for treatment should be followed. The admixture of iron, quinine and strychnia is often found to be beneficial. The nasal and neighboring cavities should be investigated and treated if required.

The severe pain in this disease is greatly mitigated by the local application to the vesicles or dried scabs of finely powdered *euphorin* (q. v.).

Bourgeois advises that when the eyeball is attacked and the *cornea* involved the eye be gently irrigated with warm boric acid lotion and the cornea afterwards dusted with:

℞

Bismuth. subnit.

Pulv. amylli

āā 4.00 (5i),

Iodol.

0.50 (gr. viiss).

This is to be repeated at least daily; pain is relieved by morphia injections, acoin (q. v.) in oil, and aspirin, while the danger of iritis and its treatment must be kept in mind. As a rule *dry heat* (q. v.) is very soothing in all stages of the disease.

#### Catarrhal Herpes of the Cornea.

*Herpetic ulcer. Herpes febrilis.* (Horner).

The development of several transparent vesicles scattered over the center or periphery of the cornea constitutes a *disease distinct from herpes zoster* and other forms of corneal vesicular disease.

*Treatment.*—Before the vesicles have burst a bandage should be applied to the eye and an ointment of atropine and holocaine (q. v.) used to relieve the photophobia and other ocular discomfort. Von Graefe advises that the small vessels be opened and dusted with calomel. Subsequently hot applications, the use of ammoniated mercury ointment (q. v.) and aristol applied with an insufflator are in order. Some observers have noticed favorable results from the careful use of the galvano cautery or from touching the denuded areas with tincture of iodine (q. v.). This disease is often part of a general dyscrasia which should be properly treated. Most cases are benefited, especially when there are recurrences, by laxatives, quinine and other tonics.

The following salve is also recommended as an application to the vesicles:

℞

Ungt. zinci oxidi

22.50 (5vj),

Boroglyceridi

7.50 (5ii),

Phenol.

1.75 (gr. xxvi).

#### Superficial, Punctate Keratitis.

*Nodula cornea. Relapsing herpes of the cornea.*

A much less serious affection than the so-called descemetitis. It occurs in the form of *small, grayish dots, or elevations*, scattered irregularly towards the central portion of, and in the superficial layers of, the cornea. The condition is usually preceded for a few days by and is associated with an acute catarrhal conjunctivitis. The eye shows signs of irritation, but not of pronounced character, which disappear in a few days.

The disease, allied to *herpes febrilis*, generally shows itself in young

people, and affects both eyes. There is quite often an *affection of the nose or adjacent cavities*, a fact not to be forgotten in treatment. Vision is not much affected and eventually the dots disappear, although in some cases relapses occur and a few permanent opacities remain.

*Treatment.*—Rest, atropia and hot applications.

G. Thomsen von Golditz (p. c.) for cases of *superficial keratitis* in the stage of repair applies the following twice a day:

R		
Hydrarg. oxidi flav.		0.30
Adep. lanæ		
Aquæ dest.	āā	1.00
Petrolat. alb. ad		10.00

In cases of the disease *associated with chronic conjunctivitis* A. C. Rogers (p. c.) prescribes 1 to 3 drops daily of a 25 per cent. solution of the glycerite of tannin and is guided by the reaction in a further dosage.

Instead of making actual contact with the point of the cautery, D. W. Greene (p. c.) in *superficial keratitis* heats the metallic point to a cherry-red color and approaches it to within half a mm. of the corneal surface (or as near as possible without touching it) so as to destroy only the superficial debris that accumulates in these cases. This method *produces effective asepsis* without destroying any normal tissue, and without scarring results.

In *diplobacillary infections of the cornea* Homer E. Smith (p. c.) has several times obtained improvement from the hypodermic administration of *antidiphtheritic* serum, 3000 units, using locally a 20 per cent. solution of trichloroacetic acid.

#### **Punctate Keratitis.**

*Serous iritis. Aquo-capsulitis. Descemetitis.*

This is a condition which occurs in inflammatory states of the uveal tract (iris, ciliary body and choroid) and consists of deposits of fine dots of lymph, mainly from the ciliary body, on the posterior surface of the cornea. It is merely one symptom of a deep seated disease and has nothing to do with an inflamed cornea. The dots are usually arranged in the form of a triangle with its apex pointing toward the center of the pupil. Sometimes the whole of the posterior corneal surface is so covered.

The *treatment* of this serious affection must follow the particular variety of *uveitis* (q. v.) assumed by the disease of which it is a part. Generally speaking, the most satisfactory local applications are atropia and dionin in full doses. When the tension is decidedly increased paracentesis or iridectomy, followed by hyoscine, may be substituted for atropine, since an iritis is invariably present, and the employment of ese-



rine or pilocarpine is pretty sure to be followed by posterior synechiae, with loss of eyesight and, perhaps, total destruction of the eye. The latter drug used hypodermically in from 1/12 to 1/4 grain doses, acts admirably in almost all phases of the disease, especially when combined with iodides internally and sweat baths. I have used them for two-week periods alternately with *sodic salicylate* (q. v.) administered as Gifford recommends.

With the foregoing as adjuncts any general or local condition likely to aggravate or to produce the uveitis should be attended to—nasal disease, gout, syphilis, etc. Radium has been spoken of by C. H. Williams as helpful in encouraging the absorption of the exudates.

#### **Phlyctenular Keratitis.**

*Vascular keratitis. Fascicular keratitis. Lymphatic keratitis. Strumous ophthalmia. Scrofulous keratitis. Pustular keratitis. Phlyctenular kerato-conjunctivitis.*

Phlyctenular keratitis is an important and common disease of childhood that often occurs in conjunction with phlyctenular conjunctivitis (q. v.), and depends upon the same causes for its origin. There first appears on some portion of the cornea (usually in the neighborhood of the limbus) a small, grayish elevation, which consists of an accumulation of lymphoid cells covered with epithelium. The epithelial covering breaks down in a very short time and leaves an ulcer. Several may form in the same neighborhood and coalesce, or each heals, to be followed almost immediately by one of a similar nature. This may go on until the greater part of the cornea has been invaded. *Leashes of vessels* form and traverse the cornea from the conjunctiva, extending to each ulcer, and if the disease is very extensive the whole cornea may be covered by a network of bloodvessels. Sometimes perforation into the anterior chamber takes place, followed by all the undesirable results accompanying such a condition.

This form of ulcer usually leaves permanent opacities of greater or less density. Relapses are frequent and the disease may last many months before a complete cure is obtained. This disease is usually accompanied by *intense photophobia, lachrymation* and *blepharospasm*, from irritation of the nerve endings in the cornea. The child always seeks the dark corners of a room, or buries his head in a pillow or in his mother's lap, apparently to escape the light.

*Spasm of the orbicularis muscle* is probably the chief cause of this symptom, because a few drops of a 2 per cent. solution of cocain instilled into the affected eye relieves the so-called photophobia, when it would aggravate it under other conditions. The lids are swollen and tightly closed; the little patient continually rubs his lids with his hands

in the vain endeavor to relieve the pain or foreign body sensations from which he suffers. The conjunctival lining of the lids is red and in some cases presents a "raw-beef" appearance, while a troublesome fissure in the skin at the external canthus is not uncommon.

*Eczematous patches* are usually found on the face or about the ears; erosions of the same kind may be seen at the angles of the mouth, and the alæ of the nose, and frequently there is suppuration of the middle ear. The mucous membrane of the upper air passages is congested and the extension of the inflammation through the lachrymal passages aggravates the disease. The profuse lachrymation and the consequent discharge of tears and mucus along the nasal duct into the nares make the child act and feel as if he had an acute coryza and furnish one of the best marked characters of the disease.

*Treatment* should be carried out as *described under phlyctenular conjunctivitis* (q. v.).

In making applications to the eyes of children, it is well to repeat that the head should be firmly held between the knees of the surgeon seated on the chair while, facing him on another seat, the nurse holds the child's body in her lap, the hands and feet closely grasped to prevent struggling.

One or two drops of a 1 per cent. solution of sulphate of atropia should be instilled into the eyes sufficiently often to keep the pupil fully dilated. The photophobia (*blepharospasm*) is best relieved by the frequent (every hour or two) *application of cold or iced cloths to the lids for five minutes at a time* and will be found very grateful to the patient. The conjunctival sac may be flushed with solutions of boric acid, gr. 10 to the ounce, or corrosive sublimate 1 to 10,000, several times a day if the eczema of the skin of the lids is not extensive. It is well to avoid the use of watery solutions in the latter case. *Milk* (q. v.) may then be used to wash the face and lids. The *fissures of the external canthus* should be touched with a 1 per cent. solution of nitrate of silver. An ointment of the yellow oxide of mercury, gr. 2 to 5 to the ounce, should be placed between the lids at night and the same mixture applied three times daily to the patches of eczema about the face. It is well to introduce a small piece into the nose at the same time. Where the ulcers show a tendency to chronicity massage with a stimulating ointment is useful to promote healing. For this purpose brown ointment (q. v.) will be found of value.

The nasal mucous membrane should be treated with appropriate remedies.

*A sine qua non is the improvement of the general health*, particular attention being paid to life in the open air, bathing and proper

diet. As a rule meat should not be allowed; at most not more than once a day. Eggs and milk, especially the latter, should constitute the greater portion of the diet. Pies, cakes, candies and other sweets should be strictly prohibited. *Plenty of outdoor exercise, especially, should be insisted upon*, and if the child can be removed to more healthful surroundings and given a change of air and scene improvement usually soon follows. Internally, the administration of the syrup of the iodide of iron, liq. arsenicalis, cod liver oil, etc., is of the highest importance, first of all *regulating the bowels with small doses of calomel or gray powder*. The following formula will usually be found most helpful:

℞	
Liq. potass. arsenitis	
Liq. potassæ	āā f. ʒiiss
Aquæ dest.	f. ʒii.

A teaspoonful in a tablespoonful of water, after eating, three times daily.

One must always bear in mind the possibility that the phlyctenules may be *miliary tubercles*, in which case appropriate treatment, especially with *tuberculin*, should be applied.

If the ulcers do not soon heal they should, after disinfection and under a general anesthetic, be touched with the *electro-cautery* or some other escharotic, one of the best being *tincture of iodine*.

One must not forget the *employment of dionin* in these cases. Darier advises a one per cent. solution as an analgesic and lymphagogue and has, in common with many others, found it of extreme value in this disease.

J. J. Gardner, (p. c.) believes in *cauterizing quite freely, with nitrate of silver stick*, the upper lid in *any inflammatory corneal condition* accompanied by *photophobia and blepharospasm*. It acts like a charm in children with phlyctenular inflammations. His method is to wet the lid surface lightly with water then rub the stick along the lid in the direction of the muscle fibres, being careful to keep any from entering the conjunctival sac, and if the solid crystal be used not to rub too freely. If properly done he has never found that it needed repeating.

When this form of *keratitis* is accompanied by profuse lachrymation Ray H. Dean (p. c.) uses *xeroform* (Merck) as a dusting powder, not only to the cornea and conjunctiva but on the skin surface of the lids.

Dudley S. Reynolds (p. c.) believes that the disease yields readily to proper treatment, whether it affects the conjunctiva only, the cornea

only, or both. When it is uncomplicated by blepharitis marginalis, no local treatment is advisable. For a child, four to eight years of age, 1/50 grain of bichloride of mercury and 1/10 grain of sulphate of quinine may be given every hour, from the time of arising in the morning until bedtime. This treatment results in invariable relief of the photophobia within the first four days and complete recovery of the patient in about ten days. The mercury and the quinine may be given, the former in tablet triturates and the latter in pill or granule form, one tablet and one pill to be given together as a single dose. In old, chronic cases, the same good result may be had from the following:

℞		
Tinct. cinchonæ comp.		
Aquæ menthæ pip.	āā	fl. ʒiii
Sodii chloridi		ʒss
Hydrargi bichloridi.		gr. i

Shake well and take a teaspoonful in half a glass of water every two hours.

#### **Mycotic Keratitis.**

##### *Aspergillus keratitis.*

This uncommon form of ulcer of the cornea sets in with severe pain, lachrymation and photophobia. A small, black body is soon visible in the *substantia propria* and this, when removed surgically or by sloughing, leaves an ulcer. The recognition of the lesion, the removal of the aspergillar foreign body, the use of atropia, (q. v.) and the treatment of the ulcer by iodine or some other cauterant, will be found quite successful. A wash containing boric acid with 1:10,000 of bichloride should also be employed, hot, for washing out the sac.

In 1:1000 solution H. V. Würdemann, (p. c.) finds *chinosol* (q. v.) of value in the local treatment of *mycotic keratitis*.

#### **Xerotic Keratitis.**

##### *Keratomalacia. Exhaustion ulcer. Necrosis of the cornea.*

This extremely rare disease was first described by von Graefe and is seen in children suffering from marasmus. The treatment must be directed to the general condition, while locally the remedies commonly applied in simple ulcer (q. v.) of the cornea should be exhibited.

#### **Vascular Keratitis.**

##### *Pannus. Trachomatous keratitis. Superficial vascular keratitis.*

This is primarily a disease of the conjunctiva, extending to the cornea and is generally due to an infection from trachoma.

Formerly inoculation of the eye with *gonorrheal pus* was a recognized remedy for pannus. It was often effective in thinning the pannus and the danger of corneal perforation was much less than in the

normal eye, on account of the vascularity of the cornea. But, it has of late years been replaced by the use of *jequirity* (q. v.), *abrin* (q. v.), *jequiritol* (q. v.) and similar remedies which produce much the same effect with less risk.

Although the use of this remedy (see *Trachoma*) is not without danger, yet if certain rules are followed the subsidence of the jequirity inflammation finds the eye in much better condition and a marked reduction of the opacity will be noticed.

Nuel has advised that *jequirity should not be employed unless* the pannus is complete, because the cornea in the non-vascular areas may perforate. He also lays down the rule that the palpebral conjunctiva should be in a granular or cicatricial condition with little or no discharge. The cornea of the fellow eye should present more or less vascular keratitis. If there is much mucopurulent discharge too great reaction will follow the use of the drug, ulceration and perforation of the cornea may ensue and the eye may be lost. Another sequel of the injudicious use of jequirity is a suppurative dacryocystitis.

#### **Keratitis Disciformis.**

*Disciform or disc-like keratitis.*

Occasionally, in the middle layers of the cornea, a grayish opacity in the form of a disc develops. The superficial layers of the cornea are usually not affected, although small ulcers may appear. Generally a permanent scar remains. Fuchs advises the use of atropine locally, together with the internal medication of any general disease. *Dionin* locally and *in full doses* will also be found of use.

#### **Punctate Keratitis.**

*Serous iritis. Descemetitis. Serous cyclitis.*

As Bruns points out and as has been noticed elsewhere in this Chapter there is no such disease as punctate keratitis; it is the sign merely of a deep-seated affection of the uveal tract and as such must be treated with it.

#### **Filamentary Keratitis.**

This is another unusual disease of the cornea, sometimes associated with wounds of that organ. It is characterized by minute globules attached to the cornea by twisted threads or pedicles. It may easily be mistaken for herpes of the cornea. Curretting the filamentary globules and the use of a collyrium containing a 2 per cent. solution of *chloride of ammonium* (q. v.) are recommended.

#### **Marginal Keratitis.**

This is an uncommon disease and the name probably includes a number of different types, notably that of Fuchs, *keratitis marginalis profunda*.

*Treatment.* The conduct of these cases must be influenced by the signs and symptoms present. For the relief of pain a mixture of dionin, holocaine and atropin is very valuable. The following formula is recommended:

℞	
Dionin.	gr. iii
Holocain.	gr. ss
Atropin. sulph.	gr. ii
Aquæ dest. ad	fl. ℥ss

One drop to be instilled into the eye four or five times a day. If the ulcer is distinctly marginal and does not soon heal insufflations of calomel or calomelol (q. v.) are indicated. Should the ulcer continue to extend along the periphery of the cornea it must be curetted, stained with fluorescein and the electrocautery applied.

#### **Grill-like Keratitis.**

*Guttate opacities of the cornea* (Fuchs). *Family punctate degeneration of the cornea* (Fehr).

Described by Haab and thought by Darier to be due to an infiltration of the corneal lymph channels by excess of leucocytes. The latter observer recommends for its treatment instillations of *dionin* (5 per cent.) and *subconjunctival injections* (q. v.) of *sodium chloride*.

#### **Neuroparalytic Keratitis.**

##### *Neuropathic Keratitis.*

The involuntary cleansing and moistening of the eyeball by winking (when the edges of the lids, acting like a rubber scraper, push secretions, dust, etc., towards the puncta where they are sucked into the nose) are indirectly brought about by the irritation of the cornea, either from drying of its surface or by the impact or contact of extraneous substances. When common sensation is destroyed, from *paralysis of the ophthalmic branch of the fifth nerve*, the eyeball is imperfectly cleansed and an infective keratitis may follow, resulting in ulcer, with hypopyon and loss of sight. A good example of this disease is the corneal ulceration *following removal of the Gasserian ganglion*. In *paresis of the seventh nerve*, when there is *lagophthalmus* and the patient is unable to close the eye owing to insufficiency of the orbicular muscle, in marked ectropion and after a loss of a portion of the lids practically the same form of corneal infection may occur.

*Treatment* consists in covering the eye with an eye-shade when anything interferes with the proper protection of the cornea, and the *instillation of sterile castor oil or vaseline* four times daily after *washing out the sac with boric acid solution*. Atropin and a mild antiseptic

solution should be applied when the disease shows itself, and the case treated as for spreading ulcer.

A weak solution of eserine or pilocarpine seems to be useful in some of these cases. Of course the treatment of the cause is the most important matter. Niden advises hypodermic injections of strychnia in the temple.

Masten\* describes a method of approximating the lids in cases of *ulceration of the cornea due to corneal exposure from paralytic ectropion*, etc. A piece of gauze is folded upon itself and a truncated triangular section is cut out, the folded side representing the truncated portion. In size this should be somewhat smaller than the upper lid. Another piece is similarly cut out for the lower lid. By means of flexible collodion one flap or half of the first piece of gauze is cemented, apex downward, to the upper lid. Likewise one flap of the second piece is cemented, apex upward, to the lower lid. A stout piece of silk thread with the free ends toward the temporal canthus is now placed in the creases made by folding the pieces of gauze over upon themselves. These upper or loose flaps are now cemented with collodion to their respective under flaps already fastened, in such a manner that the cord is freely movable through the loop formed by the gauze. Care should be taken to keep the gauze loops and cord free from collodion.

In cementing the gauze to the lids it is well to have the dressing a few millimeters back from the ciliary margin so as to allow room for plenty of traction on the lids. Tying the free ends of the cords will bring the lids in firm apposition. Instillations and medication may be introduced into the conjunctival sac at the pleasure of the surgeon or nurse by untying the silk, after which the lids may again be closed. The dressing is moisture proof and permanent. It will remain adherent ten days or two weeks.

#### **Circumscribed or Central Parenchymatous Keratitis.**

*Keratitis profunda. Deep keratitis.*

This is never an ulcerative process, but is a gray exudate, in the shape of a central disc or cone in the deeper layers of the cornea. It is a very chronic affection, and may last for months, in spite of treatment, which, if Holmes Spicer be correct, should be directed chiefly to the cause of the disease—gout and defective elimination—with diosmin, atropine and massage with stimulating ointments, such as *iodine-vasogen* (q. v.). Subconjunctival injections of *hetol* are also indicated.

Reis (*Zeitschr. f. Augenheilk.*, Sept., 1907) has described the ana-

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\* Masten. *American Medicine*, April, 1907.



tomical appearances of this rather uncommon disease, a well-defined, central, parenchymatous infiltration of the cornea with involvement of the uveal tract in an otherwise healthy girl. Although no distinctly tubercular lesion was found, yet Reis believes the disease to be tubercular.

I have recently had, in the right eye of a perfectly healthy boy, one of these deep infiltrates, without cyclitis and with very little pain. There was a neighboring patch of scleritic congestion. The patient did not react to any of the tuberculin tests, but under finger massage, full doses of dionin and atropine, with subconjunctival injections of 1 per cent. salt solution, the deep exudate has slowly cleared in the course of a year's treatment.

### **Syphilitic Punctate Keratitis.**

*Keratitis punctata profunda. Keratitis punctata vera, Mauthner.*

The above is still another form of punctate deposits in the cornea, a rare and late luetic lesion. The interstitial dots are probably minute gummata and the *treatment*, generally successful, is almost entirely anti-syphilitic. There is no iridic complication and few irritative symptoms to combat.

### **Pemphigus of the Cornea.**

*Keratitis bullosa. Vesicular keratitis.*

This rare disease often accompanies pemphigus of the conjunctiva. In spite of all treatment the eye is generally seriously damaged or the vision lost. The conduct of these cases consists chiefly in the relief of pain and the reduction of the glaucomatous tension (q. v.) that is commonly present. Puncture of the blebs should be performed, afterwards treating the denuded areas as ordinary corneal ulcer (q. v.).

### **INJURIES, BURNS, SCALDS AND OTHER WOUNDS OF THE CORNEA.**

In lesions due to *hot water, hot oil or lard, match ends, cigars, curling irons and some chemicals*, there is, of course, great pain, photophobia, lachrymation, swelling of the conjunctiva and eye-lids, as well as more or less mucopurulent discharge with scleral and pericorneal injections.

*Treatment.*—When the burn is produced by lime or other caustic alkali, the sac should be gently but thoroughly irrigated with very dilute (one per cent.) vinegar. All solid substances should be washed out with sterile water. Guillery and zur Nedden, after an experimental study of *lime burns* conclude that shortly after contact a change in the mucoid substance is brought about and a compound formed which is responsible for the characteristic dense opacity. After a time this whitish appearance gives way to a still whiter opacity, due to a deposit of lime carbonate. During the first stage much of the

opacification may be removed by applying three times daily, with an eye-cup, a 5 to 10 per cent. watery solution of ammonium tartarate (q. v.) rendered neutral by a little liquor ammonia. The application is somewhat painful and cocaine had better be used.

After a deposit of calcic carbonate takes place little can be done.

Gosselin recommends for the removal of *lime opacities of the cornea* the application of *syrup* (solution of sugar) but this treatment is condemned by Parsons\* as deleterious.

If the burn be produced by an acid the irrigating fluid should be a weak solution of sodic bicarbonate. Subsequently, cold compresses should be used and pain checked by the occasional instillation of the following mixture:

$\mathcal{R}$	
Holocain. hydrochlorid.	gr. ss
Sod. borat.	gr. vi
Aquæ dest.	fl. $\bar{3}$ ss.

Fortunati warmly recommends picric acid in the treatment of *chemical burns of conjunctiva and cornea*, especially by lime. He uses an ointment of 20 centigrammes of picric acid with 10 grammes of white vaseline. The medicament is applied twice or thrice a day, the conjunctival sac having first been rendered anesthetic by cocaine, to mitigate the smarting caused by the picric acid. The results of this treatment have been surprising, particularly when the acid has been applied from the beginning, after the eye has been carefully cleansed, and before the supervention of ulceration and secondary infection. The clearing of opacities, even when deep and wide, is often marked. Treatment should be continued until a cure is complete. Fortunati's work is most suggestive, and the means indicated by him should be given a trial in these difficult cases.

The same dangers (symblepharon, ectropion, entropion, etc.) are likely to follow these injuries of the cornea that result from conjunctival accidents (q. v.) and they should be met in the same way. Most of them have as sequels opacities of the cornea which seriously damage sight.

#### Mechanical Injuries.

These generally follow such accidents as scratches by the finger nail, by cinders, pieces of coal and other foreign bodies, and give rise to photophobia, lachrymation, pain, foreign body sensations and other symptoms that call for immediate relief.

*Treatment.*—All foreign bodies should be removed. As a rule

\* J. H. Parsons. *Pathology of the Eye*, 1908, p. 1131.

holocaine, as in a previous paragraph, may be used sufficiently often to relieve pain. The conjunctival sac should be thoroughly flushed with a 1 to 10,000 use of *formalin* (q. v.), atropine should be instilled and the eye protected from light and dust. In the case of infection of wounds these should be treated like corneal ulcers, (q. v.) by the curette, galvanocautery, iodine, phenol, (q. v.) or other agents.

In the treatment of ulcers and wounds of the cornea, Rohmer has found *peroxide of zinc and bitartrate of potassium preferable to iodoform*, but the pain caused by the application of either of the agents named to the cornea should be prevented by the previous use of cocaine.

Valois (*Recueil d'ophtalmologie*, Jan., 1907) reports the case of a child, seven years of age, who had a *severe wound of the cornea with prolapse of iris*. After excision of the prolapse all went well for a week, when the eye became painful, with circumcorneal injection and *minus* tension. The uninjured eye showed fine descemetitis and fixed pupil. The injured eye was excised and the sympathetic symptoms abated, but recurred ten days later. Two drops of a 1 per cent. solution of cyanide of mercury (q. v.) were injected deeply into the socket of the excised eye. Next day the redness of the eye decreased, but as the descemetitis persisted, the injection was repeated two days later. A week later the eye became red again, and ten drops of the solution were then injected, with the result that the symptoms entirely disappeared after a few days. The pain caused by these injections may be lessened by adding a little cocaine to the solution. This is the third case of sympathetic ophthalmia which Valois reports having saved by means of these injections.

L. R. Ryan (p. c.) has found the best application *in burns of the cornea* to be a few drops of the following, instilled every four hours, or oftener if necessary:

R

Acid. carbolic.

gtt. i.

Olei olivæ

fl. ʒi

### Conical Cornea.

*Keratoconus. Staphyloma pelucidum.*

This is rather a rare condition characterized by a slowly progressive protrusion of the cornea in the *shape of a cone*, the result of the intraocular pressure upon thin and weakened corneal tissue. At the apex of the cone is often observed a slight opacity. It is usually seen in young adults, generally of the *female sex*. If the patient look straight forward the deformity may be detected by a side view of the cornea at its temporal aspect. Placido's disk, or the ophthalmometer,

shows a marked distortion of the image indicating a high degree of *irregular astigmatism*. This anomaly is accompanied by a marked defect in vision which is but slightly improved by glasses.

*Treatment.* Lenses, selected empirically and patiently, after many trials, may increase the visual power, but reduction of the cone by the use of the *galvanocautery* is the most reliable agent.

*Cauterization of the cornea* may be carried out by various other agents than electricity, but the latter is preferable. The eye should first of all be placed under atropine and cocaine and it must be remembered that the reaction and subsequent scar should be proportioned to the extent and character of the cone. Perforation should be avoided and quite one-half of the area of the pupil should be left unburned. Knapp uses a *convex electrode*, never heated more than dull red, with which he superficially cauterizes a pyramidal-shaped area from the center of the cornea, about four mm. down and out. He then waits a few seconds and burns another but smaller zone within the other. Finally the electrode is placed in the center of the area, the platinum heated red-hot and withdrawn.

#### **Tattooing of the Cornea.**

When remedies fail to clear up the opacity on the corneal tissue, and particularly when the blemish is a broad macula or leucoma, the disfigurement may be disguised by tattooing it with ordinary *india ink*, introduced by de Wecker in 1869, or with colored pigments. After the eye has been cocainized, a paste, made with sterile water and the best quality of india ink, is spread over the scar tissue with a medicine dropper. The pigment is now pricked into the cornea with a needle devised for the purpose. The ink paste is washed off the cornea from time to time, to note the effect of the operation. If, during this procedure, pain or tenderness is complained of, the tattooing should be stopped and finished at a subsequent sitting. As the ink grains are in time absorbed this little operation should be repeated every two or three years.

#### **Corneal Tuberculosis.**

This is probably a more common disease than has been previously suspected. The best *treatment* is that by *tuberculin injection*, the application of the electrocautery, such disinfectant lotions as a saturated solution of boric acid (with atropia) in 1-5000 of sublimate, and the employment of a dusting powder of *iodoform*, *xeroform* or some other substitute for the former remedy.

S. Lewis Ziegler has reported a case of *keratitis tuberculosa treated by tuberculin*. The right eye was affected, the nodes being located in Descemet's membrane. In the onset the case closely resembled interstitial

keratitis, the salmon-colored patch and vascularized marginal ring being present. Later, isolated tuberculous nodules appeared.

For two months tuberculin injections of 3 to 5 minims had been administered once or twice a week. There had been a local reaction twice, and a systemic one three or four times. Improvement had been slow, but steadily progressive, and the patient rapidly convalesced, although the central opacities in Descemet's membrane would doubtless interfere permanently with good central vision.

#### **Other Diseases of the Cornea.**

Apart from surgical procedures there is no satisfactory treatment for the following corneal conditions: *Pigmentation, buphthalmus, congenital ectasia, tumors of the cornea, blood-staining of the cornea, atrophy and sclerosis, especially at the limbus, staphyloma corneæ, corneal leprosy, arcus senilis, striped or striate keratitis, and xanthelasma of the cornea.*

# CHAPTER XL.

## NON-OPERATIVE TREATMENT OF DISEASES OF THE CRYSTALLINE LENS SYSTEM.

*Cataract—Hard or Senile Cataract—Soft Cataract—Traumatic Cataract—Non-Operative Treatment of Cataract—Bottle-finishers' Cataract.*

### CATARACT.

Opacity of the crystalline lens is the result of structural changes in the cells and fibres of which it is composed, or of an exudate between them. Sometimes these alterations of structure are irregularly distributed throughout the body of the lens, as in most cases of *senile cataract*; sometimes they are mainly central (*nuclear cataract*) and not infrequently they are confined to the periphery or cortex (*cortical cataract*). There is a great variety of cataracts, but the most practical division of them is into "*soft*" and "*hard*" cataracts. Speaking generally, the soft variety occurs in persons below thirty or thirty-five years of age, while the hard variety is found in older patients.

#### **Senile Cataract (Hard Cataract).**

This is the commonest as well as the most important form of the disease, the cortical variety being most frequent.

The normal lens gradually grows larger and denser as we grow older and exhibit other senile changes; the lenticular nucleus in particular becomes firmer, and with the rest of the lens acquires a yellowish tint and transmits less light than formerly.

When the pupil is widely dilated the grayish, translucent outline of the whole crystalline body is distinctly visible, both with the oblique illumination and by reflected light. While these alterations, attendant upon old age, may be regarded as more or less physiological, they are closely allied to true cataract. In the latter instance, however, delicate lines, or well defined streaks of opacity, best seen by reflected light with a dilated pupil, add themselves to the normal translucent gray of the lens. These commonly begin at the periphery or equator, and slowly invade both cortex and nucleus until the whole crystalline is involved.

The pictures made by progressive senile cataract, from the time when the first faint striæ appear until the cataract is complete, are

often very pretty, and remind one of the geometrical shapes one sees when snow flakes are examined with a lens.

The time occupied by the process varies greatly, but may extend over many years. Some opacities remain stationary during life.

*Symptoms.*—Sight will not be much affected until the nucleus (in the area of the pupil) is involved. The patient then complains that images are distorted or multiplied (*polyopia*), or that there is a cloud, or floating body, before the eyes. During this period (*incipient stage*) the sectors or streaks of opacity, when viewed through the dilated pupil, appear grayish by oblique illumination, and black with the reflected light of the ophthalmoscope, the red reflex of the fundus showing through the clear portion of the lens. The fogginess increases very slowly until finally the visual acuity is reduced to the counting of fingers. In the early stages, before the opacity has completely invaded the periphery, vision is better in a dim light, because the moderate dilatation of the pupil that occurs in a partially illuminated room, for example, permits the patient to see through some, as yet unaffected, peripheral parts of his lens. Occasionally a person blind in a bright light is able to read if he shades his eyes with his hand.

As the cataract advances the lens swells, becomes more convex, and the patient may be able to discard his reading glasses entirely (although the affected eye always sees worse in the distance), owing to the increased refractive power of the crystalline. He then develops the condition commonly known as "*second sight*." When the cataract is ripe or mature the whole lens is opaque, and it can safely be removed from the capsule by operation without leaving any soft lens matter behind. Such a cataract should have a *mother-of-pearl appearance by oblique illumination*, and while the examination is being made (the pupil undilated) the iris should not cast a shadow on the lens surface. *Shadows cast by the iris on the lens indicate that the anterior layers of the crystalline are still immature and transparent*; the shadow being thrown on the opaque nucleus. There should also be no glittering sectors or facets brought to view as the patient is told to look in different directions during the examination.

*When an operation is undertaken on an immature cataract* the soft, glue-like portions of the unripe lens stick to the parts in the anterior chamber, and resist ordinary attempts to remove them. These small masses not only act as foreign bodies, producing irritation and inflammation of the iris, but transparent at first, finally become opaque, and lower the visual acuity.

In time the cataract becomes *hypermature*, or over-ripe. It may



then shrink, or, becoming soft, semi-fluid, or of a milky consistency, allow the hard nucleus to sink to the bottom of the capsule cavity, showing there is a small amber-colored body (*Morgagnian cataract*). In such cases the iris loses its natural support, and an iridodonesis is the result. Sometimes the opaque lens takes on a dark brown color, and with the oblique illumination the pupil presents a black, almost normal appearance, although the cataract is mature (*black cataract*).

*Cataract may remain stationary*, and unless the opacity involves the central portion of the lens, vision may be very little impaired. Even when the opacity involves the pupillary area, it may take several years for the cataract to mature, and become favorable for removal.

*Treatment.* In some cases of genuine cataract the *opacity has disappeared with or without treatment*, and there can be no doubt but that *diabetic striae not uncommonly disappear* or the occasional cloudiness of the lens due to exudates between the fibrillæ may undergo absorption, but apart from these considerations the application of drugs produces little or no effect. For a number of years past the claims of the tincture of *cineraria maritima* (q. v.) have been urged in an irregular sort of way, but although a number of observers, including myself, have given it a fair trial it has not been found to be of any value. *Massage* with various ointments, the *subconjunctival use of potassium iodide, dionin* and other local treatment have been resorted to, but with little or no effect. The majority of cases of cataract are progressive and when useful vision is lost a surgical operation is needed.

H. W. Woodruff (p. c.) believes in the internal use of the *syrup of hydriodic acid or iodonuclloid* for long periods of time with short intervals of rest. He says: "I did this at first without any faith in its influence, but more to be doing something. Now, however, since the subject has of late been discussed by various French and German ophthalmologists in connection with the local use of iodide of potassium, I have paid more attention to these cases and believe that the internal administration of this drug not only has more effect in retarding the progress of senile cataract, but even to some degree causes a diminution in the density of the opaque striæ in the lens. I have had no cases of incipient cataract in which I have been able to follow this treatment for a long period of time in which the vision has grown worse."

The *non-operative treatment of cataract* in its early stage is of greater interest to us than the conduct of cases of complete or mature cataract, inasmuch as the latter is entirely operative. All forms of incipient cataract due to general conditions should be treated in conjunction with the general health. Every source of eye-strain should

be removed, refractive errors, muscular anomalies and other organic lesions of the eyes should be strictly looked after. If the opacity is confined to the pupillary area dilatation of the pupil with *euphthalmine* or weak *atropine* drops, and the prescription of amber tinted (q. v.) or smoke tinted lenses, will increase the visual power. When the cataractous striæ are chiefly in the periphery of the lens, the annoying diffused light may be shut out by the use of miotics, say, a weak solution of (one-half of one per cent.) pilocarpin.

A. J. Erwin (p. c.) applies *iodine by means of the galvanic current* for the cure of *incipient cataract*. He applies it over the eyelids for five minutes once a day for at least once a month, using two to five dry cells. He prefers the *liquor iodi comp.*, the latter no stronger than is sufficient to barely redden the skin. Internally he uses an iron tonic.

In *incipient senile cataract* Pflugk employs daily or tri-weekly *subconjunctival injections of potassium iodide* in the following formula: Potassium iodide, 0.2; sodium chloride, 0.2; distilled water, 10.0; to this is added 1 drop of a 1 per cent. cocain solution to each gramme of potassium iodide solution, and of this mixture one-half to one syringeful is injected at each sitting. In the intervals between the injections, dionin powder is insufflated into the conjunctival sac. After employing this treatment for four weeks, a rest of two weeks is taken, during which time only a solution of dionin is instilled. The result of this method of treatment showed improvement in the power of vision and absorption of the opaque striæ of the lens.

Pflugk (in the Feb., 1908, number of *Graefe's Archiv.*), says that a résumé of the published histories of incipient cataract in man *treated by iodides*, shows that of the 239 eyes thus treated a great improvement in vision occurred in the majority.

The length of observations in which the opacity was controlled in the instances reported by Badal was five years, and in the 30 cases of the author, it was of varying length—as long as four years.

As the entire harmlessness of the treatment of incipient cataract by the potassium iodide method is well known, it is urged in most cases.

A review of the cases treated by the iodide method shows that a much greater improvement is to be obtained in the visual power by subconjunctival injections than by instillations and baths, solutions of equal strength being employed.

By the use of the author's method of *anæsthetizing the conjunctiva and the employment of acoin as an addition to the fluid to be injected*,

as well as its use after the injection, it is possible to render the sub-conjunctival injection of potassium iodide completely painless.

Badal employs as a collyrium a solution of potassium iodide (0.25 to 10.0) and as an eye bath (7.5 to 300.00), the latter in a gradually increasing concentration. While Badal has abandoned the sub-conjunctival method, the author has found it by far the most efficacious and painless if employed as above directed in a 1 per cent. solution.

For all the non-operative details involved in the *after treatment of normal cataract extraction* see the chapter on that subject.

Charles E. Michel (p. c.) in *cataract extraction with iridectomy*, never uses atropine before or after the operation, unless a possible synechia is to be combatted. In no case does he prescribe or permit the use of colored glasses. White light being the normal stimulus of the retina, any continued modification of it by colored glasses is objectionable, since the retina in a few hours habituates itself to the diminished light and then feels the same as previously the normal variations which may follow. This is particularly true in cases where the eye has been operated upon. He was the first to abolish the "dark room" and bandages after cataract operations, and never has even sensitiveness to light to contend with in ordinary cases.

These remarks apply to operations in the various forms of the disease, congenital, juvenile, senile, secondary or primary.

#### **Traumatic Cataract.**

The treatment of this condition to some degree depends upon the extent to which the other tissues of the eye are involved in the injury that produced the cataract. A one per cent. solution of atropine should be instilled into the eye and it is generally well to combine it, for obvious reasons, with a 2 per cent. solution of dionin and 1:5000 of formalin. An effective mixture in these cases is the following:

R

Atropiæ sulph.	gr. ii
Dionin.	gr. vi
Ungt. bichloridi (White)	ʒss

After cleansing put a little into the eye with a probe as often as is necessary.

The following *anomalies of the crystalline lens* are not affected by the form of therapy contemplated by this System: congenital lenticonus, aphakia, coloboma or microphakia.

#### **Bottle-Maker's Cataract.**

*Bottle finishers' cataract.*

Wm. Robinson (*Brit. Med Jour.*, Aug. 17, 1907) reminds us that this disease usually begins as a *posterior cortical cataract*, which dif-

fers somewhat from ordinary posterior cortical cataract. *Bottle finishers' cataract* is a primary cataract, there being no posterior mischief except sometimes disturbance of retinal pigment, and when it is successfully removed the sight is good, though the workman is rarely able to resume work as a finisher owing to the loss of power of accommodation. At its commencement it is like a cobweb in structure (and best seen with a + 10 or + 12 lens by direct examination) and saucer shaped, owing to the opacity being immediately within the posterior capsule. The outline is irregular, and not radial nor rosette-shaped.

Robinson believes that the excessive heat of the gas furnaces is the cause of the disease, an opinion borne out by the fact that the frequency of cataract in bottle-makers is in proportion to the extent and length of exposure of the eyes of the different classes of workmen to the fierce glare of the tanks. A shrinkage of the lens substance (drying) caused by the prolonged exposure to great heat may cause a slight separation of the lens fibers from the capsule first near the posterior pole, which would account for the opacity being first seen there and its peculiar saucer-like shape. The equatorial region being sheltered behind the iris, especially as the pupil is contracted by the bright light, escapes from the effect of the heat for a longer time than the cortex near the posterior pole. Cataract does not appear to be common among iron and steel workers, because the eyes of the men are not exposed to the heat which surrounds bottle finishers.

The writer recommended the wearing of dark-colored spectacles that possess the property of allowing only 30 per cent. of the heat rays to pass, and if the glass be dark colored many of the light rays are intercepted also. This suggestion has been adopted by many of the workmen, and there is already a belief that the glasses have done much good.

# CHAPTER XLI.

## TREATMENT OF DISEASES OF THE UVEAL TRACT. TREATMENT OF DISEASES OF THE VITREOUS HUMOR.

*Anomalies of the Pupil—Hyperemia of the Iris—Iritis in General—Treatment of Iritis—Various Forms of Iritis, Luetic, Gouty, Rheumatic, Gonorrheal, Tubercular, Autotoxic, Traumatic, Secondary Iritis with Cyclitis—Various Forms of Uveitis—Treatment of Diseases of the Vitreous—Diseases of the Choroid and their Treatment.*

### DISEASES OF THE IRIS AND THEIR TREATMENT.

The *iris* is a circular, colored curtain suspended in front of the crystalline lens and pierced by an opening called the *pupil*. At its periphery it is attached to the ciliary body. It separates the anterior from the posterior chamber and regulates, by means of the expansion and contraction of the pupil, the amount of light admitted to the eye.

When fully contracted the pupillary margin of the iris lies on the anterior surface of the lens, but when the pupil is dilated it hangs (or floats) free in the aqueous humor.

*The coloration of the iris* depends not so much upon the actual color of the pigment (which is brown in every eye) on its anterior surface as upon the arrangement of the pigmentation.

Contraction of the pupil is brought about by the sphincter muscle, a narrow band of fibres encircling the pupil.

The dilation of the pupil is due (1) to paralysis of the *sphincter pupillæ*, (2) contraction of the muscular coat of the iridic arteries and of (3) unstriped muscular fibres that radiate from the margin of the pupil to the ciliary body. The last two sets of fibres are controlled by the sympathetic, while the sphincter of the pupil is supplied by a third nerve.

The iris is structurally a spongy, elastic, connective-tissue membrane, abundantly supplied with vessels and nerves.

The pupil is closed until the seventh month of foetal life by a thin, semi-transparent membrane *which occasionally persists, in part or whole, after birth, under the name persistent pupillary membrane*. With the ciliary body and choroid (whose structure it closely resembles) the iris forms the *uveal tract* for providing nourishment to the interior of the eyeball.

### Functional Affections of the Iris.

Motor disorders are *miosis*, or contraction of the pupil; *mydriasis*, or expansion of the pupil; *hippus*, or alternate expansion and contraction of the pupil. These conditions are invariably symptoms of some underlying state—hysteria, neurasthenia, peripheral-nervous, as well as cerebral and spinal lesions, drugs, etc.—and they should be the chief consideration in treatment.

### Hyperemia of the Iris.

This sign nearly always accompanies inflammation of various portions of the uveal tract and may be a forerunner of it. It is also seen in deep ulcer of the cornea, keratoscleritis, and in painful infections of the conjunctiva.

The *treatment* naturally forms part of the inflammation that sets it up. As a rule the presence of an iridic hyperemia is an indication for the use of a cycloplegic—atropine, or hyoscine, in particular.

### Iritis in General.

This disease may be *acute* or *chronic*, *primary* or *secondary*, *traumatic*, *congenital* or *acquired*.

Acute attacks usually set in with discomfort and aching in and around the eye which is soon replaced by pain, due to irritation of the ciliary nerves. The pain is not only in the eye itself but radiates usually over the brow and sometimes down the cheek. As the disease advances the pain becomes worse. It is especially severe at night, keeping the patient awake, and in a short time becomes more or less constant.

*In the early stages* the eye is reddened, the injection of the vessels becoming more pronounced as the inflammation increases; particularly is this the case in the scleral margin surrounding the cornea (*pericorneal zone*) which, assuming a pinkish hue at first, soon becomes of a dusky red color.

At the same time the eyeball becomes sore and tender to the touch. *When the iritis is fully developed* the eyeball is exceedingly sensitive, probably due to involvement of the ciliary body whose blood supply is intimately connected with that of the iris. *Lachrymation* and *photophobia* are now prominent symptoms. Discoloration, loss of luster and a swollen, muddy appearance of the iris surface are early manifestations of the inflammatory changes. A brown iris, for example, changes to yellow; a blue iris takes on a greenish hue, and so on.

*The pupil becomes contracted* and its usual reactions to light and accommodation are affected; slightly in mild cases, while it does not respond at all in the severe or pronounced cases. This defect in the

normal expansion and contraction of the pupil may depend upon a number of causes: the engorgement of the iris vessels; spasm of the sphincter of the iris; exudates into the substance of the iris; or, as usually happens when improperly treated, adhesions that have formed with the anterior capsule of the lens.

Exudates are almost invariably present on the posterior and anterior surfaces and margins of the iris and are of a glue-like (plastic) consistency. This is what causes adhesions to form between the iris and lens (*posterior synechia*) and is the chief cause of blindness from iritis. The pupil is, thus, often bound down to the lens about its whole circumference (*ring synechia, exclusion of the pupil*) so that it becomes immovable; or adhesions take place at various points along the pupillary margin, causing the pupil to dilate and contract irregularly when exposed alternately to deep shadow and strong illumination. This irregular dilation of the pupil is plainly shown when a mydriatic is instilled into the eye. Eventually the pupillary space may become covered with an exudate and, if this be dense, vision is very seriously impaired. This condition is known as *occlusion of the pupil*.

*In the early stages the synechiæ may be broken down by the prompt use of an effective mydriatic, such as sulphate of atropia.* When these adhesions are thus broken up dots of brownish pigment are left on the anterior capsule in the locality where the adhesion had formed. Sometimes the synechiæ stretch as the pupil dilates, leaving a whitish thread or patch of exudate connecting the margin of the dilated pupil with the point of adhesion on the anterior lens capsule.

Vision is always more or less lowered—owing to cloudiness of the aqueous humor, deposits on the lens capsule and cornea or exudates into the pupil and even into the vitreous chamber. Interference with the focusing apparatus, due to congestion or inflammation of the ciliary body, is also one cause of a temporary interference with vision.

*Occasionally attacks of iritis are encountered in which pain and redness are either absent or are so slight as to pass unnoticed.* In these instances impairment of sight is the only symptom complained of, although on examination synechiæ are found which have been gradually forming for some time. This form of the disease is known as *quiet iritis*.

*Causes.*—*Syphilis* is accountable for about 50 per cent. of the cases, while about 25 per cent. are the result of rheumatism. The rest are chiefly due to injury, various forms of autointoxication, gout, diabetes, gonorrhea, tubercle, and, possibly, eye strain. Syphilitic iritis is usu-



ally a late manifestation of the second stage, in which small, yellowish gummata form, generally near the margin of the iris. As a rule an iritis due to syphilis is plastic in character and both eyes are affected.

*Rheumatic iritis.* Pain in this variety is usually severe, although in some cases it may be of the "quiet" variety. It may accompany an acute or subacute attack of rheumatism, *or the ocular symptoms may be the only manifestations of the general disease.* Repeated attacks are apt to occur and, as opposed to syphilitic iritis, may be confined to one eye at a time.

*Gonorrheal iritis* is rare and is more apt to occur as a sequel to gonorrheal rheumatism. It is frequently accompanied by punctate keratitis, or serous iritis.

*Serous* iritis is characterized by the formation of yellowish dots on the posterior part of the cornea (*punctate keratitis*), with cloudiness of the aqueous. In this variety the ciliary body is usually inflamed at the same time (*iridocyclitis*). The synechiæ that form are not so tenacious and are more easily broken down than in the other forms of iritis.

*Diabetic iritis* is of the plastic form and when once established is likely to persist until the eye is seriously damaged. It ought always to be detected during the general examination made in connection with every case of chronic iritis.

*Autotoxíc iritis* is an undoubted entity and to it probably belongs a fair percentage of the so-called "idiopathic" inflammations of the iris. When suspected a careful examination of the alimentary tract should be made and treatment given accordingly.

*Traumatic, sympathetic, secondary, scrofulous, malarial and tubercular* iritis, as well as the iritis due to *menstrual disorders*, are sufficiently indicated by their titles and suggest the additional treatment required by each.

*Iritis should not be mistaken for conjunctivitis, or vice versa.* Such a mistake involves the eyesight of the patient. Recognized early, iritis is usually a disease easily treated with good results. If neglected it often terminates in blindness.

*Treatment.*—In all cases the dilation of the pupil is essential to prevent the formation of synechiæ or to break down those that have already formed. As Noyes, years ago, truly said, "it is the beginning, the middle and the end of treatment." This is accomplished by means of one of the *mydriatics* (q. v.) at our disposal. The *sulphate of atropine* is probably the most useful, either in the form of ointment or solution. *A few drops of a*

*one per cent. solution of atropine should be instilled into the conjunctival sac and repeated sufficiently often to paralyze the accommodation and to keep the pupil dilated.* This may be aided or still further increased by adding to the atropin solution one per cent. of hydrochlorate of cocain and *five per cent. of dionin*. Atropine not only dilates the pupil and *prevents dangerous adhesions to the lens, but it also relieves the congestion of the vessels both of the ciliary body and iris.* It also applies the principle of the "rest cure" to the inflamed eye by paralyzing not only the ciliary muscle but the sphincter iridis.

*Smoked or amber-colored protective glasses* should at the same time be worn to protect the eye from the light and to ward off wind and dust if the patient is allowed to go out. *Hot applications* (as hot as can be borne) should be applied every hour or two in the form of moist pads, or as hot chamomile tea. Dry heat in the form of a Japanese "hot box" often gives more relief to the pain and vascular congestion than moist heat.

As before mentioned *the pain of iritis is usually severe*, and in addition to the remedies just mentioned others are often needed. *A valuable adjunct is a five per cent. solution of dionin* (q. v.). Five or six drops, each drop instilled at intervals of a minute, induce a serous exudation and marked chemosis of the conjunctiva. This artificially produced swelling acts as a lymphagogue and counter-irritant and gives great relief. When, towards night, the pains are severe and the pupil is slow in dilating, *a blister (preferably cantharidal colloidion)* applied above the brow and to the temple, about noon so that full vesication is obtained about seven o'clock, frequently gives great relief. This may be regarded as an adjunct to the employment of dionin (q. v.).

The effect of this application is to "anticipate" the usual evening exacerbation and to prevent the nocturnal pains. In some cases, especially where the vascular congestion is very great, the abstraction of blood by means of the artificial leech, or by the application to the temple of two or three of the living animals, is the most effective remedy and is necessary before the patient experiences any relief from the sufferings. *Antipyrine* in ten-grain doses, or twenty grains of *aspirin*, and even morphine are sometimes required to subdue the pains and permit the patient to sleep.

*General treatment* should be carried out when necessary by means of anti-syphilitic, anti-gonococcic, anti-tubercular, anti-lithemic, anti-diabetic, anti-rheumatic or other appropriate remedies. It is well to begin treatment, no matter what the cause of the iritis, by

opening the bowels with a dose of calomel followed by a saline. In addition to these systemic remedies the state of the general health often requires a course of iron, tonic doses of strychnia, quinin or a combination of these. It must be remembered that iritis is a local manifestation of a general dyscrasia, may last many weeks or months and may require care during the whole of that period. If adhesions have formed benefit is often derived from the *internal administration of potassium iodide* in large and increasing doses as an adjunct to the use of *atropia*, *dionin*, and *cocain*. *Sub-conjunctival injections* (q. v.) of *normal salt solution* of sodium iodate\* and of *oxycyanide of mercury* (q. v.) have also been given with success in many of these cases.

The *therapy* of a case of "quiet iritis," with its recurrences and insidious approach, requires inquiry as to its cause—whether it be luetic, gouty or autotoxic—chiefly because unless general treatment is resorted to relapses are likely to occur and the eyesight be threatened by posterior synechiæ and other sequels. In these cases the patient nearly always has some warning of an impending attack, in which case he should at once dilate his pupil with *atropine* and seek further aid from the ophthalmologist. Hutchinson regards "quiet" iritis as belonging to the *plastic* variety; other observers believe the changes to be mostly in the posterior pigment layer.

A good, average prescription (Darier) for use *when the pain of acute iritis is severe*, or when it is necessary to break up or prevent impending synechiæ is the following:

℞	
Cocain. muriatis	
Atropiæ sulph.	āā 0.10
Dionin.	0.50
Aquæ dest.	10.00

One drop in the eye every 2 to 4 hours, carefully watching the

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\*SODIUM IODATE.

NaIO<sub>3</sub>.

A white powder, soluble in forty parts of water at the freezing point, ten parts of hot water and 2.9 parts of boiling water. Externally, this remedy is used in *trachoma*, *torpid ulcers* of the cornea, *corneal infiltrations* and as a *substitute for potassium iodide and iodoform* in from 5 to 10 per cent. solutions. In addition to its employment in subconjunctival injections (one to five per cent.) in various diseases, intra- and extraocular, it may be used in the "stick" or pencil form for external applications. It has also been employed in the form of ointment, one and one-half per cent. It is also occasionally employed as a collyrium in from one to three per cent. watery solution. For wounds and abrasions it has been recommended, mixed with a two per cent. boric acid solution.

result and taking precautions against absorption by the lachrymal and nasal mucous membrane.

*The Internal Treatment of Various Forms of Iritis by Acetozone.*

Wray† having made it a rule for several years to inquire into the condition of the bowels in all cases of eye inflammations, has found, especially in children, that they are foul, often very foul, and the association is so frequent it can scarcely be a fortuitous one; hence he used to begin the treatment of such cases by the internal administration of resorcin, salol, etc. He then found that *acetozone* was used with considerable success and safety in typhoid, and inferred, as it can be used in such asthenic conditions with advantage, it might be useful as an intestinal and general antiseptic in eye diseases—especially in various forms of iritis. At first he gave it in three-grain doses, five times a day, in four ounces of water. Subsequently the amount of water was increased materially, and his present method is as follows:

The patient drinks a tumbler of water and takes his capsule immediately, after which he walks briskly for 10 minutes, and then takes a second glass of water, and again walks for 10 to 15 minutes. The first dose is taken before breakfast, the next in the middle of the morning, middle of the afternoon, and in the evening.

This acetozone-hydrotherapeutic treatment was used in 45 cases of *iritis*, serous *iritis*, and interstitial *keratitis* and in one case of syphilitic *ophthalmia*. If seen early, say, before the fourth day, iritic cases not infrequently experience relief from pain in a few hours, absence of redness on the sixth or seventh day. Of course, *atropin* and sometimes *dionin* were used at the same time.

*Correction of the (transient) myopia and astigmatism* set up by the changes in the ciliary body reacting on the lens to alter its shape is called for in some cases of *iritis*. The corneal curvature also undergoes an indefinite modification in form. All these sources of refractive error should be borne in mind and proper lenses ordered when necessary.

H. A. Kiefer (p. c.) believes in the value of *diphtheria antitoxin* for the treatment of *rheumatic iritis*. Griffin Lewis (p. c.) prescribes *aspirin* with *caffeine* and *phenacetin*\* in the following formula:

R

Aspirin.

0.60

†*Medicine* Oct. 1906.

\*PHENACETINE is an analgesic derivative of phenol occurring in white scales or crystals; very soluble in water. It is not used locally in eye diseases.

Phenacetin.	0.30
Caffein.	0.09

Divide into sixteen powders, giving one every three or four hours with 20 drops of aromatic spirits of ammonia in sweetened water.

When *solutions of atropine fail* to produce the desired effects H. H. Martin (p. c.) uses finely powdered atropine sulphate, as much as can be picked up on the point of a pen-knife, placed in the lower conjunctival sac. The eye is cocainized previous to this application and the patient or nurse directed to exert pressure with the finger over the lachrymal sac for five minutes.

When *atropine is not well borne hyoscine* (q. v.) may be used in place of it; or the following ointment, made from the alkaloids, may be substituted for the solution:

℞	
Atropin.	gr. iv
Cocain.	gr. vi
Vaselin.	℥i

In the attempt to *break up adhesions with the lens capsule* absorption of the mydriatic agents will be facilitated by the simultaneous use of adrenalin solutions.

Darier claims that the following collyrium gives the fullest effect of any mydriatic mixture. Moreover, it diminishes intraocular tension, promotes the absorption of iritic exudates and relieves pain:

℞	
Dionin.	
Cocain.	āā gr. iss
Atropin.	gr. $\frac{3}{4}$
Aquæ destil. et steril.	fl. ℥iiss

One drop may be instilled into the affected eye as often as six times daily.

When the pain is severe, the tension increased and the latter is not relieved by the usual remedies, paracentesis of the anterior chamber should be done and several drops of aqueous humor allowed to escape. This little operation may be completed under holocaine and may be repeated if necessary.

D. Bruno (*Riforma Medica*, Vol. 22, 1906, No. 4) advises as a most useful prescription in cases of *iritis complicated with secondary glaucoma*, the following:

℞	
Atropin, methylbromid.	0.10 (gr. $1\frac{1}{2}$ )
Tropacocain.	0.05 (gr. $\frac{5}{8}$ )
Paranephrin. (solut. 1:1000)	m x.

Aquæ destil. steril. 10.0 (f.  $\frac{5}{3}$  1-3)

One drop every morning, noon and evening.

Griffin Lewis (p. c.) advises the following mixture in iritis with *posterior synechia*, where atropine alone has failed:

R<sub>x</sub>

Atropiæ sulph.	0.06
Duboisin. sulph.	0.03
Cocain. hydrochlor.	0.18
Aq. dest.	8.00

von Arlt and Foerster both recommend for the effective rupture of *synechia* a *pinch of powdered atropia* in the sac, followed in a few minutes by a *little powdered dionin*. Be careful to prevent absorption by the way of the nasal duct. The dose may be repeated, if care is observed, the same day.

*Rotoin* (q. v.) has been recommended as a substitute for atropia and in the following formula is prescribed for the rupture of *posterior synechia*. It does not irritate the lids even when used for weeks at a time:

R<sub>x</sub>

Rotoin.	0.05 (gr. $\frac{3}{4}$ ),
Cocain. hydrochlor.	0.10 (gr. iss)
Aquæ dest.	30.00 (fl. $\frac{5}{3}$ ).

#### Treatment of Tuberculosis of the Iris.

This requires additional remarks owing to recent studies made of it as well as of ocular tuberculosis in general. It occurs both as the disseminated variety and as solitary tubercles—in both instances secondary to deposits elsewhere. *Tuberculin* (q. v.) is especially indicated in the disease, both for diagnostic and therapeutic purposes. The dosage and methods of employment are fully discussed elsewhere. Fuchs advises, in this disease, injections of new tuberculin beginning with a dose that will not set up either a local or a general reaction, and gradually increasing. The introduction of *iodoform* into the anterior chamber has been advised, both as an oily emulsion and in the form of Haab's rods. Failing these remedies, and especially if the ciliary body and choroid are involved, enucleation ought to be considered.

Collin has contributed to the 1907 meeting of the *Ophthalmologische Gesellschaft* his experience with the treatment of 25 cases of ocular tuberculosis, many of them intraocular, by the use of Behring's *Tulase* (q. v.) preparations. Both *Tulaselactin* and *Antitulase* were given hypodermically and were well borne by the patient. *Tulaselactin*, a preparation from cultures of human tubercle bacilli,

gave excellent results and he believed should be given a further trial where tuberculin therapy is indicated.

### Operations in the Treatment of Iritis.

When in the course of any form of iritis the intraocular tension rises so as to threaten eyesight, or when it is a source of pain and other discomfort a *paracentesis* should be done. It is also in order if the iritis does not yield to other measures. The (gentle) expression of exudates in the anterior chamber or pathological deposits on the iris or cornea may be done at the same sitting.

Iridectomy is usually done for any form of *relapsing or recurrent iritis* in the hope of preventing the attacks. It occasionally gives a good result but, especially in iritis of the gouty, diabetic or rheumatic type is not to be depended upon. When posterior synechiæ set up glaucomatous attacks, or when with an irritable eye the tension is increased iridectomy often does good. The operation should not be done if the iritis is but a part of extensive disease of the deeper parts of the uvea.

*Corelysis*, or breaking up iritic adhesions to the anterior lens capsule, is another operation that is sometimes justifiable. Unless done with care and judgment secondary cataract may follow.

### Injuries of the Iris.

The *treatment* of these traumatisms is mostly operative and varied because they include many forms of injury, especially *mydriasis*, *iridodiolysis* (separation of the iris from the ciliary body), traumatic *irideremia* or *aniridia*, *inversion* of the iris, etc.

The application of iced compresses, complete rest and protection of the wounded eye under atropia, with careful antisepsis of the injured parts—these are the principles that should guide one. Of course protruding parts of the iris in perforating wounds should be removed while foreign bodies must be extracted as early as possible.

### IRITIS WITH CYCLITIS.

Although we may have an iritis which is not associated with inflammation of the ciliary body, yet the former almost always complicates the latter. For practical purposes one may say that the general principles that underlie the *treatment of all forms of iritis are those that are of particular value in cyclitis*. For these reasons the treatment of both may be considered as the same.

Cuperus (*Ophthalmology*, abstract, Oct., 1908, p. 82) also believes that *iritis and cyclitis are too sharply distinguished in the books*. Cases of *clinically pure iritis*, even the lighter ones, are rare or do not occur. In the beginning the symptoms of iritis are in the foreground, later, even with appropriate treatment, those of cyclitis in-



tervene. The picture of pure cyclitis, however, is found where the inflammatory symptoms of the iris are totally or nearly absent. We should not speak of iritis glaucomatosa; in cases of iritis with higher tension, the ciliary body constantly participates and it is generally known that iridocyclitis is frequently accompanied by increase of tension. *Atropine* is always well tolerated in these cases when the patient can keep his bed.

de Schweinitz (*Journal A. M. A.*, June 20, 1908) reports two cases of keratitis, one of disseminated exudative choroiditis and one of relapsing uveitis (irido-choroiditis) where it seemed probable that *autointoxication* played an important rôle in the production of the trouble. Also, one case of relapsing iritis where there were no evidences of autointoxication, and a case of central exudative choroiditis with questionable autointoxication, in which, however, there existed a relationship between the choroidal changes and a furunculosis with which the patient suffered.

Careful general and laboratory examinations were made by Charles A. Fife, whose findings in one case are incorporated in the article to indicate the character of the analyses and the care under which they were made.

The author concludes his article as follows:

"1. Is there any known disease of any of the histologic systems of the eye which of itself would justify the inference that an intestinal autointoxication is present? Certainly not, because, in the first place, we have no definitely certain knowledge of any specific intoxication depending upon the non-elimination of metabolic products, and, in the second place, the clinical pictures of ocular diseases, for example, of the uveal tract, may be identical, although their aetiology may be widely different.

2. Have laboratory examinations isolated any definite toxin to the influence of which could be attributed any of the diseases of the eye at present under consideration? They have not. Hence, if such a criterion of the diagnosis of an autointoxication is necessary, as I have already stated, none of the cases recorded could be regarded as expressions of metabolic disorders.

3. Is it worth while, negative answers having been given to questions 1 and 2, to pursue the line of investigation in the cases under consideration? It would certainly seem so. At least we find or do not find the evidences of intestinal putrefaction and become acquainted with the patient's nitrogen metabolism. If the metabolism is abnormal it may be restored to the normal by a dietetic regimen, which

could not be worked out in the absence of the data furnished by such examinations."

Schiele† prescribes, for the relief of the cyclitic pain, and because he thinks it exerts a curative effect upon the disease, *sodium iodate* in subconjunctival injections (from 1:5,000 to 1:1,000) in association with a drop of a 1 per cent. solution of *acoin* for each dose. He advises that from a half to one syringeful be used each time. The injections are made as far away from the cornea as possible—usually near the equator—and are repeated every three or four days. They act both as a *lymphagogue and antiseptic*, the latter effect through the liberation of iodine in the tissues and by inducing a freer flow of blood to the parts. Schiele claims that they have a specific effect, also, on rheumatic, luetic and tubercular poisons, and that improvement in many cases of iritis, cyclitis and panophthalmitis is, for that reason, decidedly noticeable after the first injection.

Fukala\* as the result of twenty years' experience, recommends that dilatation of the pupil be secured in mild cases with 1 per cent. atropine, and in severer ones by 2 per cent. to 4 per cent. solutions. Sublimate, 1:4,000, he regards almost as a specific. After cocainization, the edge of the cornea, and then the sclera far back, is touched with warmed sublimate, applied with a small brush. In mild cases improvement follows on the second or third day after the application, but in serious cases it may not be manifest for four to six weeks. Fukala claims that by the employment of sublimate, the aqueous becomes clear, and that a commencing pupillary exudation may be completely absorbed. In *keratitis punctata*, treatment similar to that just outlined is employed with, possibly, iridectomy.

Denig (*Ophthalmic Record*, March, 1908), during the past three years has opened the anterior chamber at the limbus with a small keratome and allowed the aqueous to escape in 10 cases of involvement of the uveal tract. Four were cases of interstitial keratitis, three of iritis, two of chorio-retinitis with vitreous opacities, one of post-operative cyclitis, and one of diabetic neuro-retinitis. The operation was followed in most instances by an improvement in the symptoms.

In this connection and considering the experiments now being made with *atoxyl* and similar preparations in syphilitic and other forms of uveitis and optic neuritis, Hallopeau (*La Clinique Ophthal.*, Oct. 25, 1907) calls attention to dangers of *anilido-arsenical medication* in large doses and indicates the conditions in which this might

†*Archives of Ophthalmology*, Nov., 1908. (See foot note, p. 768.)

\**Bull. et Mem. Soc. Française*, p. 200, 1907.

be otherwise *completely avoided by lessened doses*. Hallopeau refers to a woman who had alcoholic neuritis and was given 5.10 grams of atoxyl by intramuscular injection; a few days later failure of vision was noticed and in 14 days amaurosis followed. It is quite likely that the atoxyl was the cause of the blindness; at the same time the subnormal condition of the patient should be considered, she having had alcoholic neuritis which brought a *locus minoris resistentiæ* to the action of the medicine. Then the large doses and also that the atoxyl (one of foreign make) contained free arsenates and arsenites, should be taken into consideration.

Hallopeau's personal observation is that out of 139 cases\* treated with French atoxyl in which no visual trouble occurred. In a dozen patients treated by Hallopeau with a foreign make of atoxyl two experienced difficulty, but it was transient, showing that the foreign product was different from the French make. The author refers to other cases in which amaurosis supervened after a continuous medication with atoxyl for three months. And yet atoxyl is employed in the treatment of the sleeping sickness, at times in enormous doses, 55 grams being given in a few weeks, and lately the drug has been recommended as a prophylactic for that disease. Kopke, of Lisbon, has seen 14 patients treated by atoxyl; in 6 of them visual troubles were produced, and in 3 of these blindness followed. Gama Pinto found optic nerve atrophy in two; in another case he found unilateral hemianopsia; the smallest dose had been 5.50 grams. Hallopeau's method, which he considers safe, is to give decreasing doses of the French atoxyl, the first 0.75 gram, two days later 0.60 gram and three days later 0.50 gram.

Clinically, *chronic uveitis*, according to Distler,\*\* includes a mild and a grave variety. The mild form is characterized by precipitation on the posterior corneal surface, and opacities of the vitreous; often iritic complications are entirely wanting. The prognosis is in the long run favorable. In the grave form all parts of the uveal tract are involved; generally both eyes are affected and women between the ages of 40 and 50 years are especially susceptible. The disease occurred in about 0.3 to 0.5 per cent. of the author's cases. The course is extremely chronic. Though marked inflammatory symptoms seldom intervene, posterior synechiæ are formed, often followed by pupillary occlusion. Exudates on Descemet's membrane, vitreous and lenticular opacities, choroiditic changes, and rarely optic neuritis may

\*Abstract in *Ophthalmology*, July, 1908.

\*\**Oph. Klinik*, No. 13, 1906. (From abstract in *Annals of Ophthalmology*.)

complicate the process. The prognosis is unfavorable, while in a few cases, operative interference may ameliorate the condition, the great majority terminate in glaucoma, retinal detachment or atrophy of the eye-ball. *Therapeutic measures are usually unavailing, mercury* being perhaps the most useful drug.

Distler arrives at the following conclusions:

That the causal factors responsible for acute uveitis may induce chronic uveitis.

That syphilis (at least in the authors district) is less often to blame than is generally believed.

That tuberculosis apparently plays an important part.

That *auto-intoxications certainly are worthy of careful consideration.*

Among the diseases of the iris and ciliary body not affected by non-operative interference are foreign bodies and parasites, tumors and cysts, displacements of the iris, *aniridia*, congenital coloboma, persistent pupillary membrane and other anomalies.

Although *serous iritis or serous cyclitis* might well be treated here it is, under the caption *punctate keratitis*, considered in diseases of the cornea.

### TREATMENT OF DISEASES OF THE CHOROID.

#### Inflammation of the Choroid

Alone does not set up external congestion or cause pain; it is only when it appears in conjunction with a cyclitis or an iritis, as it often does, that either the surgeon or patient is aware of its existence from external signs and symptoms. Choroiditis also differs from external diseases of the eye in that the majority of its varieties are not associated with evident secretions.

In the *suppurative* forms of the disease the whole interior of the eye (panophthalmitis) is usually implicated; in the *non-suppurative* varieties one generally sees isolated patches or discrete exudates scattered over the fundus, or the disease is confined to one or two large deposits in some particular part of the background.

#### *Causes of choroiditis.*

Like iritis and cyclitis, with which inflammation of the choroid is so often associated, choroidal diseases generally depend upon some general intoxication—*syphilis, scrofula, tubercle, gout, rheumatism, anemia, chlorosis, autotoxemia*; and *traumatism*. It may arise also from the extension of a scleritis, a retinitis, a cyclitis, an iritis or even an optic neuritis.

#### Hyperemia of the Choroid.

A red, *congested fundus* is, without doubt, sometimes due to en-

gorgement of the choroidal vessels following "eye-strain;" it may also be a precursor or an accompaniment of a choroiditis.

*Treatment.* The removal of the cause of the choroidal engorgement, the correction of refractive and muscular errors and the prescription of ocular rest form the chief part of successful treatment. Most of these indications are met by *atropia*, the wearing of tinted lenses and the application of dry heat to the ocular region three or four times daily.

#### **Simple, Non-suppurative Choroiditis.**

*Acute choroiditis. Senile choroiditis. Guttale choroiditis. Disseminated choroiditis. Central choroiditis. Myopic choroiditis.*

As may be easily anticipated from our knowledge of the etiology of these forms of choroidal disease the determination of the character of the underlying disease—lues, auto-infection, etc.—is the all-important consideration. The cause of the choroiditis is often discernible by the ophthalmoscope; indeed a study of the fundus changes is probably the most valuable means we possess of properly directing treatment. In *choroiditis disseminata*, for example, we have a picture almost pathognomonic of syphilis. In luetic lesions the treatment is generally very successful if it is applied before the tissue destruction, especially of the overlying retinal elements, is too great. It is in these forms of choroiditis that subdermal or intravenous injections of mercurial preparations, *inunctions*, *large doses of iodides*, alone or in conjunction with pilocarpine sweats, Turkish or cabinet baths, will be found very efficacious.

In nearly all the *acute cases* the eyes should be put at rest with *atropia*, colored glasses should be worn and the patient should avoid brightly lighted rooms or direct sunlight. In addition to the general treatment proper to each case, leeching or dionin (or both remedies) is of some value.

That a *concomitant iritis*, iridocyclitis or hyalitis should receive attention goes without saying.

In the *chronic forms of choroiditis* I believe that *subconjunctival injections* of normal saline solution, followed by or alternating with similar employment of potassium iodide or iodate are sometimes efficacious, particularly in clearing the vitreous opacities that often prove to be the most serious sequelæ of the disease.

Gifford's plan of prescribing *sodic salicylate* (q. v.) should also be borne in mind, especially in the simpler or non-luetic forms of exudative choroiditis.

It must be pointed out that a definite distinction should be made between atrophic areas and old deposits in the choroid and fresh.

recent lesions. The latter furnish some hope of repair; the former are the scars of a partially healed or wholly healed process and any endeavor to cure *them* is to attempt the impossible. Again, we find that a correct diagnosis is essential to rational treatment.

### **Suppurative Choroiditis.**

*Panophthalmitis. Suppurative or infective uveitis. Metastatic chorioretinitis.*

As most cases of diffuse, suppurative uveitis are due to injury the attention of the surgeon is, of course, directed to this important cause, whether it be operative or accidental. As even the mildest forms of the disease (circumscribed suppurative choroiditis, for example), are fraught with the gravest consequences to vision and generally progress until the eye is destroyed, it is important to use the most effective prophylactic measures we possess when danger threatens, as well as to begin treatment at the earliest stage of the infection.

In threatened infection of the intraocular contents from *exogenous infection* the path of infection should be disinfected at once with *iodoform rods*, or by means of intraocular injections of 25 *per cent.* *argyrol*, given once or twice daily. Iced compresses are always indicated and in proper instances blood letting. A Credé poultice of collargol, applied to the eye at night, is often of decided benefit. Infected corneal or scleral wound, operative and other, should be touched with the galvanocautery.

In all forms of infection from without we must not ignore the testimony of observers, like Woodruff, who find great benefit from *deep*, sub-conjunctival injections of mercury oxycyanide. Definite directions for the use of these valuable adjuncts will be found under *Subconjunctival Injections* and in the alphabetical list of drugs.

*Pain* sometimes is relieved by iced compresses and full doses of aspirin at night; occasionally, hypodermic injections of morphia are required.

In the milder forms of the disease inunctions of mercury with iodides internally, or large doses of sodium salicylate, certainly assist in checking the progress of the disease. More is to be expected of this treatment, also, in the localized infections and in those cases of metastasis where the invasion of the posterior chamber is not too virulent.

When, in spite of all treatment the disease grows worse, the pain more violent and the swelling of the lid and orbital tissues more pronounced *enucleation* of the globe is in order. If the œdema of the tissues and the other signs of the disease are very marked it is, perhaps, better to incise the cornea, apply hot fomentations and wait



a day or so until the emptying of the intraocular abscess gives some relief before doing the complete excision. At the same time I have frequently removed a panophthalmitic eyeball surrounded by a brawny infiltration and œdematous lids with great relief to the patient and without any subsequent evidence of involvement of the brain cavity. Yet, it must be remembered that well-authenticated cases of post-operative meningitis are on record.

In the performance of an enucleation it is wise to avoid wounding the conjunctiva any more than is absolutely necessary; symblepharon or cicatricial bands in the conjunctival sac may demand an operation for their repair before an artificial eye can be worn with comfort.

#### **Rupture of the Choroid.**

Usually little can be done to repair the actual damage of the original injury, yet the involvement of the neighboring retina can probably be limited by complete rest of the eye, especially by the instillation of atropia and the use of tinted, protective goggles; or a pad and bandage. The patient had better lie in bed and have frequent, very hot applications made to the whole ocular region. This can be done in conjunction with leeching, dionin and a collargol poultice.

#### **Albinism.**

Although this congenital condition is usually described under anomalies of the choroid it must be remembered that it is signalized by the general absence of physiological pigment.

The *treatment* has generally been the use of tinted lenses (I would suggest large, *coquille-shaped, amber glasses*) the correction of any refractive error which, as Gould has pointed out, is often present in the form of "pressure" astigmatism, and the occasional use of pilocarpine or eserine to diminish the size of the pupil. Recently Komoto (*Klin. Monatsbl. f. Augenheilk.*, May, 1907) has suggested the *subconjunctival injections of India ink* for the purpose of rendering the bulbar walls less penetrable to light. He used this remedy in a 16-year-old albino, introducing the pigment beneath the conjunctiva in various directions and repeating the experiment at the end of a week so that the globe was dark colored all over. To increase the effect of this procedure he also tattooed the cornea and injected the lid skin. The effect was instant and good; the photophobia disappeared and the vision improved in either eye from finger counting at five feet to 20/50. Subsequent experiments with opaque white substances—lead carbonate, for example—did not give as good results.

Galtier (*Annales d'Oculistique*, Feb., 1908) has repeated Komoto's experiments and found that the ink tinges the sclera blue-white,



is followed by no bad consequences and is not disfiguring. He suggests tattooing a circumcorneal ring, 4 mm. wide, to further add to the opacity of the ocular walls.

*Tumors, coloboma, wounds, atrophy, detachment of and hemorrhage into choroid* are diseases not reached by the forms of treatment contemplated by this System.

### **DISEASES OF THE VITREOUS HUMOR.**

There are few of these affections that are not secondary to other lesions of the eye, or are not dependent upon intrauterine disease or some other systemic condition.

#### **Hyalitis**

May be *simple* or *suppurative*. The treatment of the former, as it is almost always symptomatic of pathologic changes in the choroid, ciliary body or retina or is due to injury is merged in that of the causes producing it.

#### **Suppurative Hyalitis.**

*Purulent infiltration or inflammation of the vitreous.*

This is an exceedingly serious condition and is nearly always a part of a general intraocular infection or inflammation. It is usually *part of a panophthalmitis* (q. v.) and is generally the result of penetrating injuries of the eye, metastatic choroiditis and other lesions. The treatment is entirely symptomatic, the intraocular use of *iodoform* (q. v.) as well as the *introduction into the interior of the eye of mercuric chloride, argyrol and chlorine water*, may be mentioned—but without enthusiasm.

#### **Vitreous Opacities.**

These are the results of a great number of different pathologic causes and vary greatly in size and character. Their *treatment* should be directed first of all to the removal, if possible, of their cause and the prescription of certain remedies known to bring about absorption of them. These are particularly *pilocarpine sweats* given with large and *increasing doses of iodide of potassium and pilocarpine*. At the same time saline laxatives and mercurial inunctions are often prescribed with benefit. Subconjunctival injections of normal saline solutions, alternating with the local application of dionin is generally of benefit.

Fuchs (*Text-Book*, p. 467) thinks that saline mineral waters ought to be used in conjunction with other remedies, and that repeated paracentesis of the anterior chamber (to stimulate tissue changes in the eye) may be of service.

The *use of galvanism* (q. v.) is recommended by several observers, but I have not been able to observe any benefit from its use.

When the opacities are due to syphilis, or non-penetrating trauma,

treatment is of decided value and markedly good results follow the medication just indicated.

In the cloudiness and other opacities due to causes not connected with these conditions, very little benefit ensues. To this it may be added that the *hyalitis of myopia* and of other refractive errors, including anemia, menstrual disorders and digestive affections are decidedly affected by treatment directed towards a removal or relief of these disorders. The treatment of congenital opacities is by no means satisfactory. Some large, membranous opacities may, as Bull advises, be reached by discission.

#### **Subhyaloid Hemorrhage.**

*Effusion of blood between the retina and vitreous.*

F. C. Hotz described this disease in 1893, but it is of rare occurrence. The patient's general condition should be investigated and any systemic disease appropriately treated. Complete rest of the eye under atropine, the regulation of the dietary and mode of life and the use of *iodide of potassium* in large and increasing doses with *pilocarpine* *sweats* (q. v.) will be found useful. As the prognosis is favorable, proper treatment will generally bring about a cure.

#### **Hemorrhage into the Vitreous.**

Apart from vitreous bleedings due to the rupture of a diseased vessel or as a consequence of hemorrhagic choroiditis, high degrees of myopia, syphilis and disease of the ciliary body, not a few instances of *spontaneous hemorrhage* occur.

*Treatment.* This is practically the same as the conduct of cases of opacity of the vitreous humour. After a purgative followed by a saline laxative, *hypodermic doses of pilocarpine* (q. v.) should be given with sweat baths if the patient can stand this vigorous treatment. *Iodide of potassium with mercurials* can be used later with advantage, or, if they are not too powerful, can be given in conjunction with this treatment.

#### **Relapsing Vitreous Hemorrhages.**

According to Vasquez-Barriere this almost always binocular affection is very rare and occurs in about 1 out of 5,000 eye patients, chiefly in men of from 20 to 30 years of age. The hemorrhages may recur very frequently, from eight to ten times within a few months, and may be completely absorbed; may, however, by destruction of the vitreous, detachment of the retina and retinitis proliferans, lead to complete blindness. So far ligature of the common carotid had been performed for its relief in three cases, by Mayweg, Axenfeld and G. S. Derby, Jr.

Kyrieleis\* assumes a frail condition and permeability of the walls of the blood vessels and ascribes the hemorrhages to increased blood pressure from fluctuations at the time of puberty or menopause. Excepting cases of extreme anemia, hemophilia, senile cachexia, he recommends *venesection* (q. v.) in relapsing ocular hemorrhages, and, if not successful, as a last refuge the ligature of the common carotid. He believes, however, that venesection has two advantages over the ligature: under aseptic precautions it is a perfectly harmless procedure and it may be repeated without damage as often as required. Venesection decreases the tension in the vascular system, but must be combined with long continued *rest in bed*, and *non-irritating* diet in order to exclude increased heart's action. Iodine should also be given internally.

#### **New Vessels in the Vitreous.**

This is a rare condition and when due to lues yields to a considerable extent to the *internal administration of iodides and mercurials* (q. v.). In a number of reported cases this neoplastic network with its attendant cloud has almost entirely disappeared.

The *following anomalies and diseases of the vitreous humor are very little, if at all, affected* by any form of non-surgical treatment:—coloboma, persistent hyaloid artery, detachment of the vitreous, pseudoglioma, or localized exudate, foreign bodies, animal parasites, synchysis scintillans, or cholesterine crystals in the vitreous, and fluid vitreous.

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\*Abstracted in *Ophthalmology*, Oct., 1908.

## CHAPTER XLII.

### NON-OPERATIVE TREATMENT OF DISEASES OF THE LACHRYMAL APPARATUS.

*Catarrhal Dacryocystitis—Lachrymal Abscess—Stricture of the Nasal Duct—Prelachrymal Abscess—Infantile Dacryocystitis—Dacryoadenitis—Rare Diseases of the Lachrymal Apparatus.*

#### **Catarrhal Dacryocystitis.**

*Dacryocystoblennorrhea. Mucocele.*

This condition is generally due to an *incomplete stenosis of the lachrymal passages* or is an acute attack which has not resulted in a suppurative infection. Its usual symptoms are epiphora with a mucoid discharge from and dilation of the sac, and a catarrhal conjunctivitis with the symptoms proper to that condition.

The cause of the original disease, often lues, should be sought for and cured. The use of *adrenalin sprays to the nose* is usually of benefit as it reduces the swelling of the nasal mucous membrane, and this treatment should be employed in connection with applications to the duct itself. The *syringing of the canaliculus and duct, first with adrenalin and cocaine or with a 10 per cent. codrenin (q. v.) mixture* may be followed by the use of astringents introduced with the lachrymal syringe. Some of the best of these are *20 per cent. of glycerite of tannin in water*, 1 per cent. nitrate of silver, 1-3000 *calcic, zinc or potassic permanganate (q. v.)* creolin 4 per cent., toluidin blue 1 per cent., or zinc chloride  $\frac{1}{2}$  of one per cent.

Thomalla advises the following mixture under the name rhinalgin, to be made up as a suppository and placed in each nostril twice daily when there are any nasal complications:

℞		
	Alum. n.	0.01 (gr. 1/6),
	Ol. valerian.	
	Menthol	āā 0.06 (gr. 3/8),
	Ol. theobromæ	1.00 (gr. xv).

When fluids can be injected into the nose a good antiseptic and astringent lavage can be had from:

℞		
	Aluminii acetatis	3.00 (gr. xlv),
	Aquæ dest.	100.00 (fl. 5iijss).

J. A. Andrews, (p. c.) *injects into the nasal duct dilute tincture of iodine combined with glycerine and sodium bicarbonate*, the strength of the iodine solution varying according to the nature of the case.

#### **Stricture of the Nasal Duct.**

*Electrolysis has been employed for the relief of this stricture with some success.* A canula is passed into the duct and applied to the battery or electric appliance in the usual way. Desmarres and, more recently, Lagrange, believe that electrolysis will cure a case of ordinary lachrymal stricture rapidly and painlessly. The current should be a weak one and either end of the probe should be insulated so that the electrolytic action may be applied where it is needed. Lagrange advises from 2 to 4 milliamperes for two or three minutes at a time every third or fourth day. The negative pole is the probe or sound, the positive pole being placed at the back of the neck. The treatment by electrolysis is to be used at the same time that probes are employed.

When *lachrymal abscess* supervenes one or other canaliculi should be slit up and a probe passed into the nose so as to permit of good drainage. When the latter act is impossible, the abscess should be opened through the nasal skin, the cavity curetted, washed out with *hydric peroxide*, packed with xeroform gauze and permitted to heal from the bottom.

The cause of the disease should be searched for and, when found, properly treated; syphilis with the usual drugs; struma with strychnia and iron, good food and hygienic remedies; nasal diseases as each indicates.

When the stricture of the duct cannot be cured by milder means (the use of probes or styles) and within a reasonable time, *removal of the lachrymal sac* and, possibly, *a portion of the lachrymal gland*, should be favorably considered.

After operations (extirpation of the lachrymal sac, slitting of the canaliculus with or without the subsequent passage of nasal-duct probes, sounds or styles) on the canaliculus and duct or in an attempt to relieve the stricture that is nearly always present in this disease, both the sac, abscess cavity and nasal duct should be thoroughly cleansed with *hydrogen dioxide* or *potassium permanganate*. Anel's syringe is commonly used with a sufficiently large canula and any of the following solutions injected into the nose: *calcium permanganate*, 1:3000 (q. v.); *zinc chloride*, 1-10 of 1 per cent., *formalin*, 1:4000, *tannic acid* 2 per cent. In these cases argyrol, protargol and the other organic salts of silver are contraindicated *because of their liability to produce argyrosis*.

J. G. Roberts (p. c.) uses heavy ointments and medicated bougies

in the treatment of *stenosis of the lachrymal ducts*. Formerly he prescribed a salve with a cocoa butter base. Following the passage of the lachrymal probe a lachrymal syringe is loaded with this ointment, is medicated with  $\frac{1}{2}$  per cent. silver nitrate, or occasionally zinc sulphocarbolate. The syringe is introduced well into the duct and slowly withdrawn as the contents are expressed into the duct or sac so that they are kept dilated and medicated while the ointment is slowly melting.

In *disease of the bone* associated with dacryocystitis iodoform mixed with glycerin or oil has been recommended as an injection. In all these preparations it should be as finely divided as possible; there should not be visible even with a powerful lens the minutest crystals, for if present they act as irritants and one loses to some extent the purely antiseptic action of the drug.

In *chronic mucopurulent infections of the lachrymal sac* H. V. Würdemann (p. c.) employs the following mixture:

$\mathcal{R}$	
Acid. borici	0.60
Sod. chlor.	0.20
Zinci. chlor.	0.06
Pyoktanin. (blue)	0.03
Aquæ dest.	30.00

#### **Prelachrymal Abscess.**

This condition has nothing to do, as a rule, with disease of the lachrymal apparatus, but occurs spontaneously or as the result of injury, generally to the bone, at the inner angle of the eye. The *treatment* is mostly surgical, but as the condition sometimes presents itself in luetic patients and does not very quickly heal the fact that general medication is sometimes needed to bring about resolution should be borne in mind.

#### **Infantile Dacryocystitis.**

Lachrymal *obstruction in the new-born* is not as uncommon as it was at one time supposed. Moreover the prognosis is more favorable than similar conditions in the adult. As Jackson and others have pointed out the obstruction is rather one of lack of development than of infection, swelling or stricture of the canal ducts.

The treatment should at first be non-surgical and consists in keeping the parts clean, by the use of simple washes like the following:

$\mathcal{R}$	
Sodii. borat.	gr. xxx
Sol. adrenalin. chlor. (1:1000)	fl. ʒii
Aquæ dest.	fl. ʒii

After cleansing the sac about 6 times in the 24 hours a few drops of this mixture should be instilled in the eye, to be followed by pressure over the lachrymal sac. Later on, under cocaine or a general anesthetic, an attempt should be made to syringe the duct into the nose, first by solution of adrenalin chloride 1:2000 and subsequently with a 0.20 per cent. of zinc chloride. Any nasal disorders should be at the same time carefully treated. If this plan be carried out operative measures may, in the majority of cases, be avoided and a cure brought about in a few weeks or months.

In the *lachrymal stricture of the new-born* J. M. Crawford (p. c.) makes use of pressure applied over the sac and repeats this several times a day as an adjunct to other remedies.

#### **Dacryoadenitis.**

##### *Inflammation of the lachrymal gland.*

This is a rare disease associated with edema of and pain in the upper lid and conjunctiva, especially at the outer canthus. It is nearly always due to some constitutional disease, especially lues, which should be treated accordingly. Frequently a combination of the iodides and salicylates, or these remedies given alternately, will be found useful in doubtful cases.

#### **Treatment of Rare Diseases of the Lachrymal Apparatus.**

There is *no useful local treatment of the following* lachrymal diseases: *Tumors of the lachrymal gland*, excepting tuberculosis and possibly epithelioma which latter may be influenced by exposure to the X-ray, *neuralgia of the lachrymal gland*, *dislocation of the lachrymal gland*, *fistula of the gland*, *dacryolith*, *lachrymal atrophy*, *hypertrophy of the gland*, *leptothrix lachrymalis* or *tear stone*, *actinomycosis*.



## CHAPTER XLIII.

### TREATMENT OF DISEASES OF THE OPTIC NERVE AND RETINA.

*Congestion of the Optic Papilla—Choked Disk or Papillitis—Retrobulbar Neuritis—Optic Neuritis—Atrophy of the Optic Nerve—Hyperemia of the Retina—Retinitis in General—Albuminuric Retinitis—Retinitis Luetica—Retinitis Pigmentosa—Metastatic Retinitis—Serous Retinitis—Retinal Hemorrhages—Retinal Anesthesia—Retinal Hyperesthesia—Separation or Detachment of the Retina—Embolism of the Central Artery of the Retina—Retinitis from Excessive Light—Injuries of the Retina.*

#### **Congestion of the Optic Papilla.**

Simple hyperemia of the nerve-head may be due to disease of the central nervous system, may be part of the toxic amblyopia or be due to a refractive error. It must not be forgotten that the tissues about the disk in hyperopia may be unduly "heaped up" and give rise to the condition known as *spurious papillitis* or *pseudo-optic neuritis*.

Treatment *must*, of course, depend upon the cause whose removal should be attempted. Locally hot, followed by cold, head douches, saline laxatives and the atropine "rest cure" should be employed.

#### **Choked Disc.**

*Papillitis. Intraocular optic neuritis. Neuroretinitis.*

As the treatment of this condition (q. v.) is described elsewhere by Dr. Hecht, very little will be added here. It may be said, however, that any underlying dyscrasia should be attended to at once. In any event the local congestion is often relieved by *full doses of iodide of potassium* given with *mercurial inunction* and *pilocarpine sweats* (q. v.). The application of *leeches*, artificial or natural, to the temples is advocated by some surgeons.

Frankel (*Annales d'Oculistique*, Jan., 1908), says that lumbar puncture, considered to be palliative in tuberculous meningitis, has a number of cures to its credit in the non-tubercular forms. It is also effective in the clinical type described by Quinke as serous meningitis. In cases of meningeal hemorrhage, particularly if traumatic, the method is valuable when there is no necessity to evacuate the blood. Palliative results are likewise obtained in hydrocephalus. In *optic neuritis from cerebral tumor* care should be exercised, as sudden death has followed it, and in other instances there has been an increase of

the nervous symptoms, particularly of headache and vomiting. In the uremia of Bright's disease there may be relief, though only of symptoms.

Lezenius \*has for the past seven years treated a number of cases of optic neuritis of obscure origin by hydrotherapy. The patient was first immersed in a warm bath (29° R. or 97° F.) and while in it cold (15° R. or 71° F.) water was poured on his head. He was then, without being dried, covered with warm clothing and placed in bed. As soon as reaction set in and he felt warm all over he was allowed to get up. This treatment was kept up for weeks at a time and applied twice daily. In every instance the patient was benefited; the headache and vision measurably improved.

It appears to me that such simple and effective therapeutic measures might well be employed as an adjunct to other treatment, not only in cases of doubtful origin, but in those whose etiology is pronounced.

### **Orbital Optic Neuritis.**

#### *Retrobulbar Neuritis.*

As this condition, in common with many other diseases of the optic nerve, is set up by *rheumatism*, possibly syphilis, typhoid fever, and other infectious and systemic diseases, the treatment of the underlying factor is most important. On the whole *large doses of salicylate of sodium*, (q. v.) give good results in both the rheumatic and other types. The next best plan is that of full doses of the iodides, with pilocarpin sweat baths. If the disease tends to become chronic and the ophthalmoscope shows the *subsidence of inflammatory signs, quinine, strychnia, and other tonics should be substituted for the salicylates and iodides*. The hygienic treatment of all stages of this disease is very important.

Fleischer, in ophthalmoscopically marked *optic neuritis*, found, in 5 out of 12 cases, multiple sclerosis. He believes that acute retrobulbar neuritis is frequently a symptom of multiple sclerosis. Therefore in *acute retrobulbar neuritis* the diagnosis of incipient multiple sclerosis may be made with the greatest probability, if no other cause, such as propagated inflammations or intoxications, can be discovered.

A *chronic retrobulbar neuritis* is often the *lesion in toxic amblyopia* (q. v.), and when the diagnosis is established it should be treated accordingly.

### **Hyperemia of the Retina.**

This condition is generally a part of an optic or retinal inflamma-

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\*Klin. Monatsbl. f. Augenheilk., p. 340, 1907.

tion or as an evidence of a more distant disease. When due to a *refractive error* saline laxatives, cold water douches, atropine-rest, and tinted correcting lenses soon bring relief. These remedies may, if the symptoms are pronounced, be supplemented by the local abstraction of blood and the use of bromides.

### **Retinitis in General.**

This disease may be primary or secondary and is the result of many causes, most of them general in character. These latter have given rise to the useful designations, *diabetic*, *luetie*, (syphilitic), *renal*, *hemorrhagic*, *albuminuric*, *lukemic*, *metastatic*, etc.

The *treatment* of most of these clinical forms will be considered separately. In all cases complete rest of the eyes, tinted glasses, leeches and cold fomentations to the forehead and temples will be found useful. In addition Turkish baths, pilocarpine sweats with iodides, salicylates and mercurials are most commonly employed. The best manner of administering these remedial agents is considered elsewhere in this book.

### **Albuminuric Retinitis.**

*The retinitis of Bright's disease. Diabetic retinitis. Leukemic retinitis. Hemorrhagic retinitis. Gouty retinitis. Circinate retinitis. Retinitis of pregnancy.*

The *treatment* of these conditions is obviously merged in the treatment (q. v.) of the systemic states that give rise to them. Local medication is of very little use, although a number of remedies have been suggested. So far as the eyes themselves are concerned the relief of symptoms due to the local disease is about all that can be expected. Ciliary rest, with or without dark glasses and atropine, the use of leeches, dionin and the application of hot or cold will at various times be indicated. Of course everything that tends to improve the general condition and to combat the dyscrasia that produced the retinitis is urgently called for. When the underlying disease cannot be successfully treated the retinitis is almost certain to grow worse and to end in blindness, generally through secondary implication of the optic nerve.

T. R. Pooley\* (*Am. Jour. of Surg.*, March, 1908), urges that in all cases of *pregnancy*, it is not only desirable to examine the urine from time to time, but also to examine the eyes with the ophthalmoscope, even in a routine manner, since, as is well known to oculists, a large percentage of the cases having lesions of the optic nerve and retina, either have none or make no complaint of loss of vision; but

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\*Review in *Ophthalmology*, July, 1908.

such changes may lead after a long interval, through secondary or atropic changes, to complete blindness. He advises that *where neuro-retinitis with grave organic lesion of the optic nerve and progressive loss of vision is present*, in the later months of pregnancy, and the child, if not dead from the effects of kidney disease, may be viable, it is not only justified, but urgently demanded that premature labor be resorted to. If the danger of delay is such that to wait until this time would be to doom the patient to blindness, the operation should be performed even in the earlier months.

In addition, he advises that in these instances in which, in one pregnancy affections of the vision have occurred which have remained permanent, abortion or premature labor in the following pregnancies which occur, may be rendered necessary. He considers that the prognosis as to the recovery of vision is better in cases in which chronic nephritis does not already exist, and that the induction of premature labor or abortion both morally and legally is justified in order to save vision as well as life, and finally that women having once suffered loss or impairment of vision during pregnancy, should have the danger of again becoming so, and the relation of cause and effect, fully explained to both themselves and their husbands.

#### **Retinal Diseases Accompanying Diseases of the Kidneys.**

Rabinowitsch (*Zeitschrift f. Augenheilk*, Sept., 1907), reports 24 cases following Bright's disease, especially as to duration of life—a question of some interest to the therapist. Of 14 three died during the first month after discovery of the retinal disease; five in the second month; in the third month, one; sixth month, 2; before the end of the second year, 3. In other words 71 per cent. died within two years after the diagnosis of disease of the retina had been made. Of the 24 seventeen were men, eight between 40 and 50 years of age. Twenty had interstitial nephritis. The form of the retinal disease was retinitic degeneration, 7; hemorrhagic retinitis, 2; optic neuritis with neuro-retinitis, 12; "choked disk," i. e. papillitis, 1; optic atrophy, one; detached retina, one.

The local treatment of renal retinitis is of little use; indeed, as the occurrence of this disease, except as a sequel to such curable or self-limiting affections as *scarlet fever* and *pregnancy*, generally marks approaching death it may readily be seen that a cure of the disease is not to be expected.

The same remarks apply to the treatment of various forms of *diabetic retinitis* and *leucocythemic retinitis*, although the lesions here are sometimes not so grave as in the advanced forms of *albuminuric retinitis*.

Unless they are of syphilitic origin there is no effective relief or cure for *retinitis circinata*, *retinitis striata*, *proliferating retinitis*, or the *retinitis punctata albens* of Mooren.

### **Retinitis Luetica.**

#### *Syphilitic chorioretinitis.*

When the character of this disease is established its treatment should be met by a *prolonged mercurial course*. Inunctions are generally considered to be indicated in the early stages, but the greater effect in many instances of *subcutaneous* and *intravenous medication* (q. v.), should not be forgotten. Later on *iodide of potassium in full doses*, generally in conjunction with pilocarpine sweats (q. v.) should be given. The eyes should be set at rest with atropine, dark glasses should be worn and the hygiene of the patient should be strictly attended to. If this plan of treatment be followed and there is no actual destruction of the retinal tissues, vision may be restored even in bad cases.

In that rare form of retinal disease *retinitis macularis syphilitica* anti-luetic remedies are not very successful, owing to the tendency to relapse. The same may be said of *luetie endarteritis* owing to the actual damage or to destruction of the retinal elements.

### **Retinitis Pigmentosa.**

#### *Pigmentary degeneration of the retina.*

Although there is *no cure for this disease*, yet in all probability the internal administration of tonic doses of strychnia combined with increasing hypodermic injections of the same drug will greatly retard its progress. Instillation of a weak solution of eserine and the local application of the galvanic current have been recommended in this disease, but I have never been able to satisfy myself that they are of any value. Where syphilis is probably or certainly the cause of the disease, iodides and occasional inunctions of mercury are justifiable.

### **Metastatic Retinitis.**

#### *Retinitis from embolism. Purulent retinitis. Septic retinitis.*

As this condition *generally accompanies* and cannot be distinguished from *purulent choroiditis* or *panophthalmitis*, its treatment becomes merged in that of the former condition. Unfortunately very little can be done in the way of intraocular medication that is effective. Subconjunctival injections, the use of dionin, inunctions of mercury and sweat baths with potassium iodide may be tried.

### **Serous Retinitis.**

#### *Edema of the retina.*

*Simple retinitis involves only small areas in the retina* and is associated with engorged vessels. Vision is somewhat impaired in the parts affected.

As this condition may be produced by eye strain it is well to inquire into the state of the refraction, muscular balance, etc. It may also be an early condition of a more serious involvement of the organ and for that reason possible constitutional causes should be remembered. Whatever general treatment may be decided upon complete rest of the eyes—preferably under atropine and colored glasses—should be kept up for some time. Empirically, mild saline laxatives, with or without the administration of iodides or salicylates and sweat baths will generally be in order.

### **Retinal Hyperaesthesia.**

#### *Irritation of the retina. Irritable retina.*

This is a well recognized condition often difficult to cure and associated with photophobia, lachrymation, pain, etc., and due to a number of causes—hysteria, errors of refraction, heterophoria, nasal infections, neurasthenia, menstrual disorders and pelvic diseases.

*Treatment.* Although the correction of oculomuscular errors and the prescription of rest for the eyes are often indicated, yet the investigation of the patient's general condition as revealed by an examination of the blood, intestinal contents and urine, is the chief indication. Anything that tends to raise to par the lowered nervous vitality or that will combat a psychoneurosis may be of great value to the patient. Electricity, body massage, change of scene, tonics, an outdoor life, the successful treatment of an intoxication, the removal of a vice—all these considerations show how widely one must search for relief in some of these stubborn cases.

### **Retinal Hemorrhages.**

#### *Apoplexy of the retina.*

This complication of many local as well as central diseases of the circulatory system may be serious or otherwise according to the character of the accompanying lesion or lesions.

The *therapeutic measures* proper in such cases include the treatment of concurrent diseases while complete rest of the eyes—with either atropia or eserinc—is essential. Laxatives, nervous and cardiac sedatives with ergot are often advisable.

The therapy of *hemorrhagic retinitis* is bound up with the conditions, local and general, that determine it and these should always be considered. Local abstraction of blood, cardiac sedatives, diaphoretics and renal stimulants with or without ergot, have been recommended.

L. Webster Fox\* believes that in cases wherein pressure is found to be abnormally high, in addition to rest, exclusion of light and

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\**Ophthalmic Record*, Oct., 1908.



the usual local measures, absorption of the clot occurred far more rapidly (from one to three weeks sooner) by employing the following method:

All plethoric cases and those with greatly increased arterial tension were admitted to the hospital and *immediately bled from the median basilic vein*, following the technique usually employed in venesection for any other condition. The sphygmomanometer was adjusted to the opposite arm and the pressure recorded every three minutes. It was found that it was rarely necessary to reduce it lower than 110 mm.; for those with original pressure from 150 to 200 mm. Cases presenting systolic pressures of 200 mm. or over were seldom reduced lower than 150 mm. He was often compelled to desist before these reductions occurred, owing to faintness of the patient.

In the less robust, somewhat anemic cases, he practiced relieving hypertension with the aid of hot-air baths, electric light baths, or even hot packs. This was found to be nearly as effectual as bleeding in hastening absorption and the restoration of function of the affected eye. In the obese, and when, for any reason, bleeding was refused or was impracticable, thyroid extract gr. ii, t. i. d., was of considerable use as a vasodilator and to diminish the viscosity of the blood. The above methods, while partially satisfactory, did not tend to produce the freedom from recurrence which characterized the cases upon which venesection was performed. A number of *chronic nephritics, with whom retinal hemorrhages had been habitual for months*, have been entirely free from attacks during two years following this treatment. Although within the twenty-four hours following the bleeding the blood pressure recorded was higher than the elevation taken previous to venesection, there was a daily decline of approximately 10 mm. per diem for three to four days, which latter pressure was usually maintained for several weeks, at least as long as his observation continued. The routine treatment after the patient left the hospital was carefully regulated—nitrogenous diet, alkaline waters freely and warm baths, 110° for ten minutes, thrice weekly. Medicinal arterial relaxants were used, as sodium iodide, gr. v., in conjunction with sodium nitrite, gr. i. three times daily for three weeks of each month, omitting every fourth week.

In cases of *markedly hemorrhagic tendencies*, where there were both subconjunctival and retinal extravasations, *gallic acid gr. x, three or four times daily* was added to other measures. Hydrargyrum cum creta, gr. i, t. i. d., was used in the autotoxic cases and where the liver and intestinal tract seemed to be principally at fault.

Cases of primary and symptomatic anemia, diabetes and syphilis



were of course not treated by venesection. Fox adds that a large proportion, 80 per cent., of retinal hemorrhages occur in individuals suffering from a temporary or permanent high arterial blood pressure, due to the causes enumerated. This excessive intravascular pressure is apparently the most frequent exciting cause of these hemorrhages. Venesection has proven of value, not only in reducing dangerously high pressure, but in acting as a powerful stimulus to a speedy absorption of the clot.

### **Preretinal Hemorrhages.**

#### *Subhyaloid hemorrhages.*

This form of retinal bleeding differs from the ordinary variety in that the blood effusion is not into the substance of the retina but between it and the vitreous. In consequence the retinal tissues suffer no permanent injury from the hemorrhage and after the resorption of the extravasated blood (which is usually poured out around the macula) vision is as good as before the bleeding took place. The *treatment* consists in complete rest of the individual as well as of his eye, the treatment of the cause of the hemorrhage, if it can be ascertained, and the use of absorbents, especially pilocarpine sweats with large doses of iodides or some substitute for them.

### **Embolism of the Central Artery of the Retina.**

#### *Retinal embolism.*

Although in a few cases the embolus has been dissipated or dislodged and the retinal circulation partially or entirely restored, treatment in the majority of instances is without avail. Fischer, Würdemann and I have used, with success in several instances, *deep massage* (q. v.) *with the suction apparatus or the finger*. The earlier this measure is tried the better, and it should be used in conjunction with inhalations of nitrite of amyl.

I have also published the results of *iridectomy* in a number of cases but I cannot say that the results were encouraging. *Hypodermic injections of pilocarpine with the internal administration of salines and potassium iodide may be used in conjunction with massage*. Recurring to the last mentioned form of treatment, I am in favor of covering the lids with a little vaseline and making deep, continuous rotary and up and down movements over the globe for several minutes, intermitting them when the pressure becomes painful. This treatment should be followed for a week or ten days and not abandoned as long as the visual field or the ophthalmoscope shows any improvement.

R. A. Fenton, (p. c.) advises careful massage with the *double*

*suction cup and Victor electric pump* (pressure releases between strokes) for the dislodgment of the thrombus or embolus.

### **Detachment of the Retina.**

*Separation of the Retina. Amotio retinae.*

The local treatment of *detached retina* is most successful in the traumatic cases, and those due to curable albuminuric retinitis (q. v.). *Spontaneous reattachment* occurs in not a few instances, while in every case the probability of cure stands in direct ratio to the length of time that the detachment has existed. In the great majority of cases, the vision deteriorates and the patient becomes blind in the affected eye.

An effective method of treatment is rest in bed, dark glasses, the instillation of atropine, the employment of pilocarpine sweats, the internal administration of potassium iodide (q. v.), subconjunctival injections three or four times a week of normal salt solution, or the local exhibition of a 5 to 10 per cent. solution of dionin, both as a collyrium and, later, in the form of sub-conjunctival injections. In this connection Gifford's employment of sodic salicylate (q. v.) should be borne in mind. Ball (*Text-book*, p. 525,) gives the following interesting account of the surgical interventions that have been suggested for the treatment of this disease since Sichel, in 1855, advocated simple puncture of the sclera and choroid. They are *discission of the retina* (von Graefe), drainage by a fine gold wire passed to the choroid by means of catgut (Galezowski), dislaceration with two needles (Bowman), iridectomy (Galezowski and others), injection of iodine into the sub-retinal space (Galezowski, Gelpe, Schöler), electrolysis (Gilet de Grandmont), cutting of vitreous bands and transfixion of the eyeball (Deutschmann, Jaencke), injection of a 3 to 5 per cent. of gelatin in a physiologic salt solution between the sclera and capsule (Galezowski, Abadie), injection of normal salt solution into the vitreous after the evacuation of subretinal fluid (Walker) and injection of air into the vitreous (Jansen).

Ball remarks that most of these procedures should be ruled out of the domain of modern ophthalmology. All are dangerous to the integrity of the globe, and one of them—*intraocular injection of iodine*—has been followed by meningitis and death.

Of the surgical measures mentioned above, the most promising are simple puncture with a cataract-knife, puncture with the galvanocautery, and subconjunctival injections of salt solution. The last of these procedures has the advantage of innocuousness. Stärkle, of Basel, has reported 23 comparatively recent cases of detachment treated by injections of salt solution, its strength being increased from 2 to 10 per cent. He reports improvement in 21 cases and complete re-

attachment in 3. Dor, of Lyons, claims 14 complete recoveries in 21 cases. He used subconjunctival injections of 20 per cent. salt solution, leeches and punctate cauterization of the sclera, each of these procedures being used once weekly in rotation. Stillson of Indianapolis has saved 4 out of 5 cases of detachment treated by the galvano cautery. Winselman has had three cures following subconjunctival injections and the use of compress bandages. While these reports are highly encouraging, it must be remarked that in some of them not sufficient time has elapsed to enable judgment to be passed upon the value of the treatment. Sutphen, however, cured a case of bilateral detachment by scleral puncture and eleven years later vision was normal. Hahn and Knaggs have observed a case of symmetrical retinal detachment occurring during labor associated with albuminuria, with complete recovery. While restoration of vision is more likely to occur in recent than in old cases, some remarkable instances of reattachment are reported. Thus, Dor is said to have observed reattachment with restoration of vision after seven years and Wolfe, of Melbourne, had a successful result after three years.

Deutschmann, in speaking of his methods of operating in this disease thus sums up his experience of other procedures:

The *simple scleral or sclero-choroidal puncture*, known since 1860, was, according to Uthoff, first used by Kittel in the treatment of detachment of the retina. The results obtained by this procedure, even with the various modifications, are not encouraging. The best modification of it is puncture of the sclera by the galvano-cautery.

The *puncture or incision of the detached retina itself*, according to v. Graefe. This method gives no favorable results.

*Permanent drainage*, de Wecker regarded as obsolete.

*Electrolysis* yields no certain result, while iridectomy is purposeless.

*Intraocular injection of iodine* has been abandoned.

Cauterization of the sclera, with or without subsequent conjunctival injections of weaker or stronger sodium chloride solutions is insufficient.

Compared with the inadequacy of the foregoing measures, Deutschmann declares that he has obtained the best results from the method perfected by himself—a simpler one, which he calls "*Durchschneidung*," or *bisection*—and one which he reserves for the severest forms of this disease, which resist every other method of treatment—*viz.*, the *injection of sterile animal vitreous body into the diseased human eye*.

Bonté (*La Clinique Ophtalmologique*, Jan., 1907) prefers the

following plan of treatment: Subconjunctival injections of 1 cc. of *concentrated solution of sodium chloride* with three drops of a 1 per cent. solution of acoine, repeated at intervals of a few days; complete rest in bed; cauterization of the sclera at a number of points in the region of the detachment; treatment of the cause, myopia, syphilis, etc.

The reviewer in the "*Ophthalmoscope*," Nov., '07, of A. Maitland Ramsay's article on the treatment of detachment of the retina (*Transactions Ophthalmological Society U. K.*, 1906) remarks that it is refreshing, after reading the panegyrics of certain Continental writers on methods of treatment which seem always to be successful, to turn to a judicially-written article on the management of retinal detachment. The author has taken all his cases of the condition occurring in hospital practice over a period of four years, and reported on the results of treatment by *subconjunctival saline injections*. The exact nature of the saline varied in different cases, but the solution ordinarily used was five to twenty minims of 1 in 2,000 bichloride of mercury with 8 per cent. chemically pure sodium chloride. In some cases acoine and in others alypin, were used as analgesics. Dionine was occasionally added to the injection. Ramsay lays great stress upon attention in every way to the patient's general health, and especially upon the state of the bowels, during his period in bed. The average number of injections was five, and the average duration of treatment one month, but prolongation of the period in bed is probably beneficial if the case is one which is improving. On the other hand, if, after fourteen to twenty-one days, there are no signs of improvement, the case may be considered incurable. As soon as possible after the termination of the period of rest in bed, the patient should be sent to the country, where sometimes considerable further improvement may be expected.

As to the results, which are shown fully in tabular form, but reduced to their essence in the text; there were fifty cases treated, of whom twenty-seven received no benefit whatever. Of the remaining twenty-three, ten showed very decided improvement. Of these ten, five afterwards relapsed, the shortest period being two weeks and the longest four years, after conclusion of treatment; of the remaining five, three were satisfactory after one year and two were lost sight of. The other thirteen of the benefited cases showed moderate improvement; some of them relapsed. Ramsay concludes that favourable cases are few, the unfavorable many; but however hopeless the latter may at first seem, it is always well, before coming to the con-

clusion that nothing can be done, to try the effect of such simple treatment. It can at least do no harm.

### **Retinitis from Excessive Light.**

*Solar retinitis. Electric retinitis.*

Workers with powerful arc lights or electric furnaces, as well as those exposed to the fierce light of the sun (as in watching an eclipse) should wear *deep ruby, dark amber or other sufficiently tinted glasses*, lest their eyes be permanently damaged by a central scotoma which may correspond to a genuine, organic lesion of the papillo-macular fibres. When the symptoms (scotoma, dazzling, etc.) appear after exposure the eyes should be well shaded, atropia instilled and the case treated as one of central chorioretinitis (q. v.)

### **Injuries of the Retina.**

The *treatment* of detachment of the membrane has already been discussed. In addition, the retinal traumatisms include *rupture of the retina, perforation at the macular region* ("hole" in the retina), *traumatic amblyopia* (*commotio retinae*, oedema of the retina) and traumatic anesthesia.

*Traumatic amblyopia*, mostly due to direct blows on the eyeball from blunt objects, such as a champagne cork or golf-ball, is best treated by *complete rest of the eye* under dionin and atropine. The artificial leech and the wearing of tinted lenses are desirable adjuncts.

*Traumatic anesthesia* is relieved and generally cured by the same agents prescribed for *commotio retinae* but it may require a longer course of treatment, the exhibition of *strychnia*, and some form of *electricity* before the patient recovers. It sometimes happens that in spite of all treatment the visual defect and the contraction of the fields persist for months, or never improve.

The following *anomalies and diseases of the retina cannot be reached or are very imperfectly reached by any form of drug treatment*: Hole or defect of the macular region, glioma and other tumors of the retina, subretinal cysticercus, thrombosis of the retinal artery and veins, Tay's choroiditis or symmetrical changes in the macular region, angioid streaks in the retina, retinitis proliferans, striate and punctate retinitis, including Gunn's "crick" dots, colloid changes and *retinitis punctata albescens*, sclerosis and aneurism of the retinal vessels.

When it is possible to do so the causes, local or general, that give rise to any of the foregoing pathologic states, should be treated *secundum artem*. Many of them are considered in that portion of this System, devoted to the treatment of systemic diseases that produce eye symptoms.

### Atrophy of the Optic Nerve.

This disease may be *primary or secondary* and its treatment will depend upon the conditions that give rise to it as well as upon the extent to which it has advanced. When the underlying causes—toxic agents, syphilis, diseases of the central nervous system, injuries to the head, optic neuritis, etc.—can be successfully treated or removed there is some hope for improving the central and peripheral vision of the patient. But it often happens, it is almost needless to repeat, that when this cannot be successfully done the patient or his friends must be warned that sight will probably get progressively worse. It must be remembered, however, that disease of the optic nerve is *occasionally stationary* and may remain so with or without treatment. In *syphilitic* cases the therapy is evident—mercurials, potassium iodide or both remedies in full doses. When there is no marked hyperemia of the optic nerve and only slight engorgement of the vessels, strychnia, especially in its hypodermic administration, should be used for a month at a time, until large doses (I have frequently given as much as  $\frac{1}{3}$  of a grain hypodermically every day for a week) are taken. Derby reports improvement in 30 per cent. of all the cases treated by him.

In conjunction with these remedies preparations of arsenic (I have used *atoxyl*, hypodermically, with some success), phosphates, lactate of zinc, electricity (q. v.) and hypodermics of antipyrine, may also be tried. *Vibratory massage* (q. v.) has a number of friends and Ball (*Text-book*, p. 548) removes the superior cervical ganglion in the hope that an increased blood supply will bring about improvement in vision. He has had one successful result out of four advanced cases of optic nerve atrophy, treated in this way. He says that the operation may be done as long as the patient retains the ability to count figures at two or three feet.

Fuchs (Duane, p. 258) remarks that strychnine was first recommended by Nagel for the treatment of lesions of the optic nerve. It exerts an excitant action upon the optic nerve, so that even in normal eyes it produces a slight, although not permanent increase in the visual acuity and enlargement of the field of vision. For therapeutic purposes a one-half-per-cent. solution, of which a quantity equal to one-half or the whole of the contents of a Pravaz syringe—i. e., as much as 5 mg, (=1-13 grain) of strychnine per dose—is injected once a day beneath the skin of the temple. It acts best in disturbance of vision unattended by changes visible with the ophthalmoscope, especially in hysterical and neurasthenic forms which, however, generally afford a good prognosis anyway. In serious



lesions of the optic nerve, as in progressive atrophy, we often obtain with it an improvement in the sight and especially an enlargement of the field of vision; but these changes are commonly not permanent."

Bull\* says the treatment of *syphilitic atrophy of the optic nerve* is a subject which taxes all our patience and ingenuity. "So unfavorable is the prognosis that the ophthalmic surgeon is ready to grasp almost any means which promises a solution of the problem. Surgical interference with the optic nerve itself has yielded such imperfect and inconstant results that it has been abandoned; the same remark applies to sympathectomy. The constant current, and even electricity, have usually proved unavailing. "Much, he says, has been claimed for the treatment by *vibratory massage*, but he has never personally known of a case of atrophy which has been benefited by this method. In advanced cases of syphilitic atrophy of the nerve he believes mercury administered internally to be useless, and it may do real injury. Roborant treatment, directed to the general health, in these cases sometimes aids in retarding the degenerative process. In regard to the employment of subconjunctival sublimate injections, he has arrived at the following conclusions: "1. Posterior subconjunctival injections of sublimate may be given with but little pain if the sublimate injection is preceded by the injection of cocain. 2. The conjunctiva should be incised and carefully separated from the episcleral tissue, and the injection made far back towards the apex of the orbit. 3. The eye need not be bandaged after the injection, but cold applications should be made for half an hour; and 4. This method of treatment of cases of atrophy of the optic nerve has, in my hands, proved of no more value than the usual routine treatment by mercury, potassium iodid, and strychnia, and offers no encouragement for its continued use."

#### **Amaurosis from Uremia.**

Unless there are alterations in the retina or optic nerve accompanying this symptom—*temporary blindness in persons suffering from chronic or acute renal disease and similar conditions*—the prognosis is quite favorable. The attacks of blindness rarely last longer than from 12-24 hours and a return to normal vision is the rule. During the period of recovery, temporary defects in the visual field have been noticed. The treatment should be directed to the *underlying disease*. Sometimes, as in the *uremia of pregnancy and scarlet fever*, this can be cured in which case the amaurosis eventually disappears.

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\*Review of his paper from the *Journal of the A. M. A. in Ophthalmology*. July, 1907.



**Amblyopia from Hemorrhage.**

The *optic nerve involvement* in these cases is not much improved by treatment of any kind. The immediate transfusion of blood, physiological salt solution or *plasma*, followed by a nutritious diet and the subsequent employment of iron and strychnia are the most satisfactory measures.

**Hysterical Amblyopia.**

*Functional amblyopia. Retinal anesthesia. Neurasthenic, hysterical or nervous asthenopia.*

Like hyperæsthesia of the retina this condition is often but a part of a neurosis with which it is not easy to deal.

The *treatment* is that of the underlying defect, but *psychotherapy, massage, electricity, seclusion*, all the resources of the Weir Mitchell treatment, and the prescribing of glasses for their own sake and as *suggestive treatment*, should not be forgotten.

**Scotoma Scintillans.**

*Amaurosis partialis fugax.*

This symptom commonly occurs as a part of the *migraine* (q. v.) symptom-complex, but it may set in apart from "sick" headache.

The *treatment is largely hygienic*; both ocular and cerebral rest should be taken, all stimulants avoided and an effort made to discover and remove the cause of the symptom.

*Validol* (q. v.) in 20 drop doses has been recommended by Neustaetter. *Quinine, caffein, the bromides* and the whole range of tonic and sedative drugs have been found more or less useful in these cases.

**Functional Day Blindness.**

*Hemeralopia. Snow-blindness. Electric furnace blindness. Sun blindness.*

This is generally a congenital disease but may, also, be brought on by exposure to intense heat and light, and by errors of refraction in over-sensitive subjects.

The *treatment* consists in the prescription of smoked glasses, complete rest of the eyes, with or without a cycloplegic (q. v.), the administration of tonics and the correction of all errors of refraction and of muscular balance. A gradual return should be made to the ordinary exposure to light. In several cases that I have seen almost complete relief was afforded by the wearing of light, *amber-tinted lenses*. When pain is present, galvanism, combined with very cold or very hot fomentations, will be found of considerable value.

In *snow blindness*, there is generally sun-burn of the conjunctiva and cornea and this condition requires the treatment for simple keratitis (q. v.)

**Nyctalopia.***Functional night blindness.*

As this affection generally occurs in *anemic, malarial and scorbutic subjects* and *disappears under hygienic treatment* alone the conduct of such cases is quite apparent. The sensibility of the retina to light should be met by the wearing of amber or of other form of colored glasses.

The local (?) treatment is a curious one, namely, *the ingestion of the liver of an ox, goat or sheep*—5 to 10 ounces three times a day. It should be fried in oil and well seasoned. Probably the improvement in nutrition by this method is responsible for the result. In any event it should be accompanied by a course of tonics, salt water bathing and other hygienic measures. It is, perhaps, unnecessary to add that the night blindness of retinitis pigmentosa and other organic diseases of the optic nerve and retina is not affected by this remedy.

Mallanah (*British Med. Journal*, Feb. 22, '08) regards *urotropin* in full doses internally as a specific in the *torpor retinae*, xerosis and pigment conjunctivitis underlying this symptom.

**Colored Vision.**

Almost every form of this symptom, from *erythropsia* or red vision, sometimes seen in neurotic subjects and occasionally brought on by the excessive use of coffee, *cyanopsia* or blue vision, seen after cataract extraction, yellow vision, *xanthopsia*—a symptom of *santonine* poisoning—and *green vision* (described by Dodd) are on record. Apart from the removal of the cause, when that is possible, the treatment is entirely empirical. Preparations of *gelatine*, *pulsatilla*, *the bromides*, etc., have been used with more or less success.

Among the *anomalies and diseases of the optic nerve that cannot be cured, improved or, at least, can be only imperfectly reached by non-surgical treatment* are the following: congenital atrophy, tumors of the optic nerve, hyaline bodies in the nerve head, optic aplasia, coloboma of the optic nerve, congenital cupping and pigmentation, optic neuritis with nasal discharge, hemorrhage into the sheath of the optic nerve, color blindness or congenital amblyopia for colors, argamblyopia or amblyopia from non-use and traumatisms of the nerve.

**Toxic Amblyopia.**

*Tobacco-alcohol amblyopia. Amblyopia from drugs and allied agents. Quinine amaurosis. Toxic retrobulbar-neuritis. Intoxication amblyopia. Tobacco amblyopia. Amblyopia from botulism or ptomaine poisoning.*

Included in this category are numerous agents, among which, in addition to those just referred to, may be mentioned *methyl or wood*

*alcohol, bisulphide of carbon, salicylic acid, malefern, mercurial preparations, naphthalin, santonine, gelsemium, benzine, aniline dyes, iodoform, thyroïdin, lead salts, the venom of snakes, tea, coffee, chocolate, oil of wintergreen, ergot, phosphorus, carbolic acid, cocaine, strychnia and arsenical preparations.*

Although the general and ocular symptoms set up by these various forms of toxic amblyopia differ greatly, yet their treatment is much the same and it applies to all of them. By far the larger number of cases occur from chronic poisoning by alcohol, tobacco, quinine, Columbian spirits and various preparations made from this form of methyl alcohol. For a complete review of the whole subject I would refer the reader to the monographs of George E. de Schweinitz and myself. A full account of methyl or wood alcohol amblyopia and its treatment will be found in a series of articles contributed to the *Journal of the American Medical Association* by the late Frank Buller and myself.

The drug or toxic agent should be discontinued and eliminated from the system. The patient should be put upon a *proper diet* and should strictly conform to all the requirements of personal hygiene. As a rule, *pilocarpine sweat baths* (q. v.) with or without the exhibition of *potassium iodide* should be used in the early stages, especially if there is any hyperemia of the optic disc or engorgement of the vessels. *Later strychnia*, both by the mouth and hypodermically, should be given in full doses.

The diagnosis, prognosis and treatment of tobacco-alcohol amblyopia are so important that I give them some additional space.

*Symptoms.*—Both eyes are affected, the patient complaining of foggy or misty vision. He almost always applies for glasses to assist his failing sight and, as the disease is entirely painless and presents no external sign, he rarely suspects the true cause of his visual defect. The acuity is lowered to at least 2-5 or 2-7 of normal, and the reading of fine print is difficult or impossible with any glass.

There are also to be noted a well marked tobacco, or ethereal, odor to the breath, a general atonic condition, some insomnia, anorexia, and there may be dull frontal pain.

This condition is due to a central color (relative) scotoma, especially for red and green. The examination to determine this sign may be made with the *perimeter* or with a strand of red and green wool. Double a single thread between the thumb and finger of the right hand, holding it so that only a quarter of an inch of the loop projects and is seen. Cover the patient's left eye with a bandage and ask him to look steadily at the pupil of the examiner's right eye at a

distance of two feet. Now, interpose the small loop of red wool in the common line of vision at a point a few inches in front of the examiner's eye. In alcohol-tobacco amblyopia the patient will not *then* recognize the loop as red, or it will appear *redder* when removed an inch or two to the right, left, up or down from the line of sight, than it does when placed directly in front of the pupil. The same result will be obtained from the *green* wool, but probably not from *white*, blue or yellow, unless the disease is far advanced and the visual acuity has fallen below 1/10.

*Treatment.* Taken in time a perfect recovery generally follows (1) total and immediate *abstinence from tobacco and alcohol*; (2) *good food, fresh air, sufficient sleep, tri-weekly Turkish baths*; (3) the administration of medicinal doses of *iron and strychnia* by the mouth, for which the following is an efficient formula:

℞	
Quinin. sulphat.	gr. v,
Tincturæ ferri chlor.	
Acid. phosphoric. dil.	āā f. ʒvi,
Liq. strychniæ.	f. ʒi,
Syr. simp.	f. ʒviii.

A teaspoonful in water before meals; (4) the *hypodermic injection of increasing doses of strychnia* daily or every other day.

Probably the temporary improvement in vision from nitrite of amyl (q. v.) inhalations indicates the employment of some form of Bier's congestion cure (q. v.) in those cases of intoxication in which the lesion is an optic nerve atrophy and this remedy might well be used as soon as anemia of the nerve head is discovered. In addition to the "hyperemia" treatment full doses of digitalis might be employed to stimulate the heart's action and insure a larger blood supply to the starved nerve fibres.

The diagnosis once correctly made this routine treatment can be prescribed with the assurance that, if faithfully followed, *a cure may be confidently expected in from one to three months.*

The *treatment of methyl alcohol amaurosis and amblyopia* is quite unsatisfactory. Some cases improve under free catharsis from jalap, calomel and salines, combined with diaphoresis from hypodermics of pilocarpin. This treatment, however, must be given during the first few days of the acute inflammatory stage if any beneficial results are to be expected. When atrophy begins to show itself *strychnine* is given hypodermatically in increasing doses until the point of tolerance is reached. *Potassium iodide* has also been used, but it must be remembered that the prognosis is very bad when signs of atrophy begin

to appear. In most cases the affection goes on until complete blindness results, regardless of treatment.

Wirsing (*Deutsche Medizin., Wochenschr.*, 1907, p. 1854), reports the case of a woman, aged 30, who took, instead of bicarbonate of soda, a teaspoonful of red lead oxide with some water. After about two weeks, symptoms of lead intoxication developed: colic, headache, tinnitus, palpitations of the heart, dyspnea, profuse perspiration, vomiting, vertigo. About two months after the accident her memory failed and visual disturbances set in with diplopia and micropsia. Then she became drowsy and could not recognize anybody.

Examination of the eyes six weeks after admission to the hospital, revealed: V. R. = 5/v, V. L. = 5/vi. Left mydriasis, reaction of both pupils sluggish, paresis of left superior oblique, contraction of left visual field about 15° to 20°, color perception normal, *optic neuritis, with commencing atrophy*, in left eye.

Under *pilocarpin-instillations, warm baths and iodide of potassium* a rapid improvement took place in the general condition as well as the eye symptoms, and the paresis of the left trochlearis was eventually cured.

Of the diseases and defects of the optic nerve unaffected by medical treatment are congenital anomalies, coloboma, irregularities of the disk, hyaline bodies (Drüsen) in the papilla, and several varieties of optic atrophy, injuries and tumors.

# CHAPTER XLIV.

## NON-OPERATIVE TREATMENT OF THE VARIOUS FORMS OF GLAUCOMA.

**Definition of Glaucoma—Acute or Acute Inflammatory Glaucoma and its Treatment—Sclerotomy, Iridectomy and Other Operative Procedures—The Use of Miotics—Chronic Glaucoma or Glaucoma Simplex—Hemorrhagic Glaucoma—Secondary Glaucoma—Buphthalmos or Infantile Glaucoma.**

Glaucoma proper is essentially a *damming or blocking of the drainage from the interior of the eye*. The chief lymph stream flows from the posterior chamber past the margin of the lens, through the zonula of Zinn, beneath the iris, through the pupil into the anterior chamber, thence through the loose tissue at the junction of the iris and sclera into the circular canal of Schlemm and from this space into the external lymph channels.

Obstruction to the steady escape of the intraocular fluids at any point in this drainage system or any undue increase of the fluids themselves may produce glaucoma. Probably the most important obstruction to the exosmosis is at the angle close to Schlemm's canal. There are two fairly well defined clinical forms of the disease, whatever their cause: actual and chronic.

The ophthalmologist has to deal with so many instances of *gouty infection*—especially *glaucoma* (Richey), *iritis* and *choroiditis*—that he should not ignore the treatment of the *general dyscrasia*. This subject will be found discussed by Dr. Croftan elsewhere, but meantime, it is wise to remember the value in these cases of *colchicum* and its preparations. As A. F. Amadon (p. c.) properly says favorable results follow the general treatment of *gouty eye diseases*, especially by colchicin alone or by I-64 of a grain of that alkaloid, given from 4 to 6 times a day, in conjunction with the *iodides* or *salicylates* in sufficient quantities to produce moderately free catharsis. The alkaloid, he adds, seems to be far superior to the tincture or wine of colchicum, and he has noticed that the more decidedly the case is of gouty origin the more benefit will be derived from this treatment.

### **Acute Glaucoma.**

*Acute congestive glaucoma; subacute inflammatory glaucoma.* All these forms of the disease exhibit acute *outbursts*, attended

by more or less pain in and congestion and redness of the eyeball. Associated with these symptoms is temporary impairment of vision—usually the first symptom—the blurring lasting for a short time, then followed by the vision clearing again. It is attended by marked increase of the intraocular tension and loss of focusing power (accommodative athenopia) which necessitates the frequent changing of the glasses, especially reading glasses, as it usually shows itself in persons over 40 years of age. During these periods the patient notices rings (*halos*) of various colors (as if one were looking through a glass that had been breathed upon) about gas jets or other flames. *The pupil is dilated and the anterior chamber becomes shallow.* These symptoms recur a number of times, each attack lasting longer than the one that precedes it.

Eventually the loss of vision becomes permanent. The pain, which is transient and slight at first, soon becomes severe and more constant. It is referred *not only to the eye itself but to the region surrounding the eye*, radiating over the brow to the side of the nose and cheek and, in the severe varieties of the disease, is very apt to be mistaken for facial or supraorbital neuralgia. The patient himself usually speaks of it as “a neuralgic attack.”

As the disease advances the pain, in the more acute forms, becomes almost unbearable and is not relieved even by morphia hypodermically or by the other analgesics commonly administered for trigeminal neuralgia. The eyeball, slightly congested at first, soon becomes plainly red and inflamed, especially in the zone surrounding the cornea (ciliary region) while the scleral vessels are dilated and tortuous. The cornea is hazy and has a “breathed-on” appearance and finally becomes more or less insensible to the touch.

Unless it is checked the disease generally progresses until it ends in complete disorganization of the structures of the globe. The lens becomes opaque, the iris atrophies and hemorrhages take place in the interior of the eyeball. Bulging of the coats of the eyeball (staphyloma, ectasia), especially in the neighborhood of the ciliary body, frequently occurs from the continuous increase of tension, until the eye feels and looks as if it were going to burst. Indeed, *removal of the globe or its contents is often the only measure that gives the patient relief from his intense suffering.*

The treatment of this form of the disease is almost entirely surgical. A wide iridectomy, sclerotomy, cyclodialysis or other procedure should be performed as soon as possible.

As a rule I am in favor of *waiting until the inflammatory storm has passed before resorting to operation.* In the interim



paracentesis, posterior incision, massage with eserine oil or ointment and, above all, the frequent use of a 5 per cent solution of dionin will cut short the attack. As a matter of fact I generally use the above measures in their reverse order, and agree with the observation of Peter Callan that the *lymphogogic effects of dionin* should be among the first remedial measures applied in these cases. In addition to local applications a large saline purgative, restriction of diet, plenty of water internally and complete rest should be prescribed.

As is well known, it is often difficult to decide whether one should do an iridectomy or not, whether, indeed, one has to deal with a case likely to pass into a glaucomatous state that will go from bad to worse unless operated on. In such cases I am in the habit of employing Edward Jackson's test of instilling into the suspected eye one or two drops of a mixture containing a two per cent. solution, each, of euphthalmin and cocaine. When the pupil is fully dilated if I find the tension palpably increased and the retinal arteries pulsating I am in favor of operation.

It also throws some light on the outcome of an operation when the action of eserine is observed; should that drug bring about a considerable contraction of the pupil followed by reduction in tension and the relief of symptoms it argues in favor of an iridectomy, sclerotomy or cyclodialysis and of good results therefrom.

When the surgeon has decided the symptoms are such as to justify surgical interference the sooner the operation of election is done the better; before iridic adhesions occur or Schlemm's canal is blocked with exudates.

von Grosz places the chief reliance upon iridectomy in all forms of glaucoma. His results after operation in 237 cases which were under observation for a long time were as follows:

In the prodromal stage, success in 29 cases..... = 96 per cent.

In the active stage, success in 146 cases..... = 87 per cent.

In glaucoma simplex, success in 62 cases..... = 70 per cent.

He operates usually after instillation of 2 per cent. pilocarpin, 5 per cent. cocaine and 1 to 2 drops of 1:1000 solution of tonogen (q. v.); in painful eyes he injects a dose of morphia beforehand. The wound is made very peripheral and a broad iridectomy is done.

Dianoux *prefers sclerotomy followed by miotics and massage*. He begins massage twice daily, commencing twelve hours after the operation. The surgeon commences and the patient continues this procedure for the remainder of the latter's life. In addition, a collyrium containing both eserin and pilocarpin, with or without cocain or adrenalin, according to circumstances, is ordered twice daily. In simple

chronic glaucoma D'Anoux recommends the following routine examination of patients, "I watch carefully the field of vision for white and colors, the light-sense, the visual acuity, and the accommodation; explain to the patient the nature of the disease and the results desired and expected from treatment, and teach him to massage his eye twice a day, and at the same time to use the drops. The examination should be repeated every month, and if there is no improvement or the patient is worse do a sclerotomy, followed by the treatment already described. Internally small doses of *quinine* and iodide of soda, alternating with small doses of tincture of *strophanthus*, may be given with benefit."

For several years it seemed as if *sympathectomy*, or the removal of the superior cervical ganglion, might to a large extent supplant operations on the eyeball for the relief or cure of this disease, but the feeling appears now to be that it should be reserved for patients in whose cases miotics and bulbar operations have failed to give relief, or where for any reason iridectomy or sclerotomy cannot or ought not to be done.

The few instances that I have seen or have myself done *optico-ciliary neurectomy* for the relief of pain in eyes already blind from acute glaucoma an *enucleation* was subsequently performed. I conclude, therefore, and have adopted the rule of doing the latter operation at once, when occasion for it arises.

Schmidt-Rimpler (*Text-book*) has so far never had occasion to perform resection of the sympathetic nerve. For alleviating the pain *cocain with pilocarpin* is recommended. In some cases of absolute glaucoma, in which all remedies had failed, *instillations of scopolamin* were useful.

Peter Callan (p. c.) strongly advises the following prescription, two drops to be used every hour until the inflammatory symptoms have passed off:

R

Eserin, sulph.	gr. i
Pilocarpin. mur.	gr. ii
Sol. dionin. (10 per cent.)	fl. ʒii

In this connection he further says: "I consider this formula of the greatest service in *acute and subacute inflammatory glaucoma*. It is not always an easy matter to do an iridectomy in an acute case of glaucoma when the inflammation is at its height. By using this mixture the surgeon may postpone the operation as long as it suits him. In fact many cases quickly recover and I fail to see the necessity for any operation. It should be used hourly until the acute symptoms have

passed off (which may take 24 to 48 hours) then every two hours. I likewise use it after simple glaucoma operations—beginning, say, 10 days after the iridectomy, using it every night or other night as the case may be. It has given me excellent results and at the same time has cost me some operations.”

Schmidt-Rimpler advises the use of physostigmine as a half per cent. solution from 2 to 6 times daily. As long as central vision does not decline and the visual fields show no diminution in size this local medication [or that by *pilocarpin* or *arcolin* (q. v.)] should be continued and no surgical procedure undertaken.

It is not yet clear how this reduction of tension is brought about, the commonly accepted explanation being that during the miosis the stretching of the iris permits of a readier exosmosis of the intraocular fluids.

American patients seem very susceptible to the irritation that follows the use of eserine and it cannot be used in the doses ( $\frac{1}{2}$  to 1 per cent.) generally prescribed by European writers. This difficulty may be avoided by giving the drug in smaller proportions *as an oily solution or in the form of ointment*. Another plan is to instil it in conjunction with cocaine or after cocainizing the eye. This procedure not only relieves the pain but increases the miotic action of the drug. I have used for several years:

R

Cocain. hydrochlor.	gr. j
Eserin. salicylatis	gr. ss
Aquæ dest.	fl. ʒ j.

The eye to be kept closed for 20 minutes after using.

Eserin lamellæ with cocain also act very nicely.

Schmidt-Rimpler gives the following prescription *for the use of the salicylate*:

R

Eserin, salicylatis	0.05
Hydrarg. bichlor.	0.002
Sodii chlor.	0.01
Aquæ dest.	10.0

A procedure followed by the *relief of pain*, and even improvement in the glaucomatous condition, is injecting, with an Anel or some other form of lachrymal syringe, the nasal duct of the affected eye with a 25 per cent solution of *antipyrine*. This may be repeated two or three times daily, if required, after previous injection with *eucapren* (q. v.) or some similar mixture.

**Chronic Glaucoma.**

*Simple Glaucoma. Chronic non-inflammatory glaucoma. Glaucoma simplex.*

In this variety of glaucoma the patient generally complains of *very few symptoms* and the disease may progress for several months before the glaucomatous character of the affection is detected. There is, however, a dimness of vision which gradually grows worse. The patient gives a history of having had many changes of glasses with the vain purpose of obtaining better sight, especially for near work. Instead of his vision becoming clearer it gets more and more obscured. The tension is finally found to be raised, even as high as T+2, although it may vary, for a time even reaching normal.

*The morbid process advances so gradually that no changes in the external appearances of the eyeball are detected. The pupil is slightly dilated but it reacts promptly to light.* The anterior chamber is of normal depth or only slightly shallower than it should be. On examination with the ophthalmoscope the media are found to be clear and a good view can always be obtained of the back part of the eye. Almost without exception the mirror reveals a well marked *cupping of the optic nerve head*.

In this slowly progressive and quiet form of the disease *treatment* of any sort is not satisfactory as in the more acute cases. Indeed the diagnosis from primary progressive atrophy of the optic nerve is not always made with ease and it is quite possible that the treatment may be unconsciously applied to the latter condition rather than to a truly glaucomatous affection. Apart from the questionable employment of iridectomy or one of its substitutes considerable benefit is derived from attention to the general condition. Any lesion or morbid influence whatever, gout, rheumatism, disease of the nose, heart, intestinal tract, kidneys, etc., should be attended to. The most important local treatment is the use of miotics—especially eserine and pilocarpine (q. v.).

As Posey has pointed out, if these remedies be properly and judiciously applied, if need be while life lasts, the disease may be held in check for an indefinite time and no need arise for the removal of the cervical ganglia, or any other procedure. It is difficult to lay down rules applicable to every case, but the method I generally employ is to prescribe a  $\frac{1}{2}$  to 1 per cent. mixture of eserine in olive oil or petrolatum, one drop, or its equivalent of ointment, to be put into the eye every morning, after which the eye should be kept closed for 5 minutes. If this is sufficient to keep the pupil well contracted a second dose is not used, during the day, but in any event, another drop is instilled just before retiring. According to the state of the eyes I em-

ploy in my office, once, twice or thrice a week, *gentle finger massage* (q. v.) generally using a 1 per cent. solution of eserine salicylate. It may be mentioned in this connection that, as Bull points out, both the hydrobromide and the salicylate are to be preferred to the sulphate on account of the greater solubility of the former.

To gain the *full benefit from miotics in the treatment of glaucoma*, it is necessary that they should be properly administered. It must be remembered that the miosis and ciliary spasm of eserine and pilocarpin persist for two or three hours only, so that the dose should be repeated at the end of this period if their action over the pupil is to be maintained. Small doses of the drug should be used in the beginning and gradually increased until the desired effect is attained. Gentle massage of the eyeball is of decided advantage, and should be practiced several times each day, for five minutes at a time.

Posey's latest conclusions on this important subject are: That miotics should be relied upon as the sole means of treatment only *in those cases* which are *free from attacks* of so-called "glaucomatous congestion," the presence of such congestive symptoms being in his opinion the chief indication for iridectomy. To gain the full benefit of miotics it is necessary that they should be administered properly. Beginning in doses small enough to avoid spasm of the ciliary muscle, and rapidly increasing the dose until the pupil of the affected eye is strongly contracted, the contraction should be maintained *as long as life lasts* by gradually increasing the strength of the solution, from time to time, and by instillations of the drug every three or four hours. Conjunctival irritation may be avoided by employing only fresh and sterile solutions of the drug. Suitable cleansing washes should be administered, and attention given to the general health and especially to the condition of the blood vessels. Careful and repeated correction of the refraction error should be made and restrictions enjoined on the use of the eyes.

Schleich (abstracted in *Die Ophthal. Klinik*, Oct. 5, 1906), reports the result both of operative and miotic treatment of *glaucoma simplex*, in cases which had been under observation more than two years. In the cases treated by iridectomy 7.8 per cent. became blind, either immediately or within a short time after operation; 76.5 per cent. showed a more or less gradual progression in the loss of function, while 15.7 per cent. only showed cessation of the process, i. e., no increase in functional disturbance for at least two years.

In a smaller number of cases (46) treated by miotics, the results were: progress of the disease in 61 per cent.; retardation in 39 per

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\**Jour. Am. Med. Ass'n*, Oct. 24, 1908.

cent. Schleich believes the prognosis after operative treatment is more unfavorable in the early stage of the disease than later in life. Moreover, the use of miotics after operation makes it difficult to determine the value of the operative procedure. He concludes that iridectomy can not be considered in any sense a trustworthy remedy for glaucoma simplex, because in the majority of cases which are followed long enough it does not give the good results usually ascribed to it, and on the other hand in a larger percentage of cases it produces immediately unfavorable results, at times rapid blindness. He believes further that the value of the faithfully employed miotic treatment has not been as yet sufficiently tested, and the bad results depend partly on a lack of thoroughness in carrying out the treatment.

Some observers have noticed improvement in this form of glaucoma from the use of the ophthalmic oscillator or vibrator in any of its forms. I have been in the habit of using the Victor machine but any instrument that will produce rapid but gentle suction with an alternating release ought to be tried in these cases.

Notwithstanding the difficulties raised by others I see no objection to combining a small amount of cocaine with eserine prescribed in watery solution. This combination is much less painful than the pure solution, it can be used by patients who would otherwise be unable to stand it, smaller doses of eserine can be effectively employed and the cocaine (q. v.) greatly adds, as we know, to the miotic effects of the drug. I would begin with the following formula:

R

Eserin. salicylatis	gr. i
Cocain. salicylatis	gr. ss
Aquæ dest.	fl. ʒvi

A drop to be put into the eye 3 times a day.

### Secondary Glaucoma.

As the name implies, this condition follows other ocular lesions, either injuries (mechanical, chemical or operative) or inflammation of some part of the eyeball; perforating wounds, especially in the region of the ciliary body; iritis with extensive synechiæ directly obstructing the drainage of the eye; dislocation of the lens; perforating ulcers of the cornea; prolapse of the iris after cataract operations; swelling of the lens from injury to the capsule; tumors of the eyeball, etc. Treatment is mostly operative.

*Glaucoma absolutum* when pain is present, *glaucoma after cataract operation*, and *glaucoma associated with intraocular tumors* call for surgical interference; *drug treatment is of no avail.*

It may also be said of *secondary glaucoma* that the treatment should be directed to the underlying cause.

### **Hemorrhagic Glaucoma.**

*Retinal hemorrhages, with marked pain, congestion of the eye and total loss of sight, constitute a very grave form of the acute disease—hemorrhagic glaucoma.*

Very little can be done apart from surgery in *hemorrhagic glaucoma*. The hygienic aspects of the case are important; all causes of worry and excitement should be avoided and the patient's surroundings should be as favorable to complete rest as possible. *Salicylate of sodium* (q. v.) *quinine* and *ergot* internally are said to be useful. All systemic dyscrasia should be promptly treated. In addition to these the indications mentioned under acute inflammatory glaucoma (q. v.) should be carried out, although it must be acknowledged that miotics produce very little effect in this discouraging disease.

### **Buphthalmos.**

*Hydrothalmos. Congenital glaucoma. Infantile glaucoma.*

Although the treatment of this disease is almost exclusively operative, yet the continued employment of miotics, especially a combination of pilocarpin with cocaine and dionin is of considerable value. I would suggest the following combination:

R

Dionin.	gr. iv
Pilocarpin, hydrobrom.	
Cocain. hydrobrom.	ãã gr. i
Sodii. chlor.	gr. ss
Aquæ dest.	fl. ʒi

A single drop of this mixture is put into the eye once a day, and when it begins to lose its effect one or more drops at intervals of two minutes may be instilled or the proportion of dionin increased, to produce a decided edema of the conjunctiva.



# CHAPTER XLV.

## NON-OPERATIVE TREATMENT OF DISEASES OF THE ORBIT AND ORBITAL WALLS. ARTIFICIAL EYES.

*Abscess of the Orbit or Phlegmon—Cysts of the Orbit—Tenonitis—Artificial Eyes and Similar Devices—Varieties of Protheses and How to Adjust Them—The Shell Eye—The Newer Snellen or Reformed Eye—Rules for the Selection and Care of Ocular Protheses—When to Change Them—Difficulties and Dangers in Wearing Artificial Eyes.*

### **Abscess of the Orbit.**

*Phlegmon of the orbit. Orbital cellulitis. Periostitis and caries of the orbital walls.*

Inflammation of the tissues within the orbit, especially of its cellular tissue, sometimes produces secondary effects upon the eye itself. The marked swelling and brawny infiltration of the lids and surrounding tissues may produce sloughing, while an intraocular affection may end in panophthalmitis.

Aside from surgical measures the patient should be put to bed, an *ice-bag should be applied (always in the early stage)* to be followed by *moist heat (q. v.) later on*. Leeches very often give relief to the pain and swelling. The administration of tincture of iron in conjunction with laxatives, quinine or strychnia is often indicated. Free and early incisions should be made into the postocular tissues in such a manner as not to damage the integrity of the eye or eye muscles. *These incisions should be irrigated, with 1:5,000 of formalin, argentine or mercuric bichloride*, and the hot fomentations continued as long as decided swelling remains. During the local treatment attention should also be paid to the cause of the disease; it is often *syphilis, scrofula, tubercle, injury*, metastasis, general infection or extension of purulent material from neighboring cavities.

### **Cysts of the Orbit.**

If these are dermoid in character, or are exudation cysts following hemorrhage or are due to hydatids or the cysticercus a cure may be the result from emptying and afterwards *injecting them with tincture of iodine, 1:1000 of calcium permanganate (q. v.), 1:3000 mercuric chloride, absolute alcohol*, or by placing in the *empty cavity a few crystals of silver nitrate*.

*Diseases of the neighboring cavities* are closely related to many affections of the orbit, and one may readily pass into the other. The *treatment of these conditions* is discussed in the chapter on this subject (q. v.) by Dr. Frank Brawley.

#### **Tenonitis.**

*Inflammation of the oculo-orbital fascia.*

This disease is *generally caused by injury, operation on the eye-muscles, rheumatism or gout.*

*Treatment.* For therapeutic purposes tenonitis (See Chapter on the Treatment of Diseases of the Ocular Muscles) may be regarded as a sign of other diseases (q. v.). The cause that underlies the inflammation should itself be treated and for this reason *salicylates, colchicum* and the *iodides with saline laxatives* are commonly prescribed. A strict dietary is, also, in order.

The *anomalies and diseases of the orbit not amenable* to non-surgical treatment are the congenital conditions and the majority of tumors, of which there is a great variety, exostosis and hyperostosis, pulsating exophthalmus, enophthalmus and the majority of wounds of the orbital walls.

#### **ARTIFICIAL EYES AND SIMILAR DEVICES. PROTHESES. PROTHESES OCULARES.**

Few are the text-books that give any considerable space to the selection, adjustment and care of artificial eyes, and yet the subject is of considerable importance both to the ophthalmic surgeon and his patient. It is not, in my judgment, correct practice to leave this work to the optician or to some jeweler who exposes a few artificial eyes for sale. The final success of an enucleation, bulbar evisceration or Mules' operation may easily depend upon the shape, size, adjustment and manner of wearing a prosthesis—details that only an experienced or, at least, *trained* surgeon can superintend.

In the following pages I have considered the most important questions that arise in connection with this matter and for the rest I would refer the reader to Pansier's *Traité de l'oeil artificiel*, 1905, a most interesting little book that will fully repay perusal. This work appeared before Snellen's improved or solid eye was introduced to the profession and, of course, no notice could be taken of that excellent improvement on the older form of prosthesis.\* With that exception, the treatise is in every respect complete to the present date.

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\*The derivation of this term is not as clear as most of our medical dictionaries would have us believe; it is probably not only a synonym but a contraction or corruption of *prosthesis*, a substitution or imitation.

**Historical.**

Not only is it well established that the Egyptians, the Arabians and the early Greeks were acquainted with the fact that an artificial eye can be worn in place of one lost by accident, disease or operative measures, but it is also certain that the oculists of ancient times were generally in the habit of adjusting these cosmetic articles.

Ambrose Paré (1579) was the first to give a precise description of the artificial eye. His work is illustrated by several drawings of prostheses that show both surfaces much like the shell eyes of our own time. He described these as made of metal, painted and enameled to imitate the human eye. Another variety, made of metal and painted leather, was edged with silk, to the outer border or which was attached a cord that passed under the hair and over the ear. By this means the eye could be removed from the orbit any time the wearer desired.

At the beginning of the 18th century artificial eyes began to be manufactured of glass. Heister, for example, in his *Institutiones Chirurgicæ*, 1750, devotes a whole chapter to the artificial eye.

Pansier\* quotes the description given by a Nevers jeweler of his method of making (about 1750) artificial glass eyes. It does not much differ from the manufacture of shell eyes in our own day.

Most of the information regarding artificial eyes, as they were made and used about this time, is derived from the thesis of Mauchart, Tübingen, 1749. From it we learn that there were at least two varieties worn in his day, *ecblephari* kept in place by an iron circlet about the head and *hypoblephari*, the ordinary shell-eye. A third class, the ancient variety, at that date rarely used, was the silver and gold eyes of the Egyptian and Arabian oculists, in more modern times painted or covered with colored enamel, to represent the iris and pupil.

Mauchart gives explicit and sensible directions regarding the care of the prosthesis—how to put it in place, how and when to remove it, how to cleanse the conjunctival sac or orbit, and how and when to use detergent lotions of most value for the latter purpose. He gives the formulæ of these collyria; an important one being a warm mixture of rose water; another with "eyebright"—all of them to be applied with a sponge. He fully recognizes the disadvantages as well as the advantages of the prosthesis, the danger of irritation of the socket, as well as the possibilities of harm to the fellow eye.

For a long time Venice enjoyed a monopoly of the manufacture of glass eyes and the strictest laws were enforced to prevent the secrets of the trade from being carried abroad. Eventually, however,

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\**Traité de l'oeil artificiel*, 1895, p. 17.

France, Bohemia and other countries became such rivals of the Venetian artists, that at the end of the 18th century the glass eyes of Murano no longer enjoyed their former commercial supremacy.

About this time Storck invented or discovered a successful method of manufacturing glass eyes and, finally, in 1818, Hazard-Mirault published his practical treatise on the artificial eye in which most of the details of manufacture, including the rules for closely imitating all the parts in the front of the human eye are plainly set forth. After him (almost with him) came the two Desjardins and Boissonneau. The last named optician was among those who made Paris the headquarters for artificial eyes for the next half century.

The manufacture of enamelled eyes was introduced into Germany by Ritterich in 1850. That country before very long displaced France in the output of artificial eyes and at length acquired possession of most of the foreign trade and has held it ever since.

#### **The Snellen and Other Modern Forms of the Prothesis.**

At the present day we in America are dependent almost entirely upon the output of German factories—especially those of Wiesbaden—for all forms of protheses. The exception is that a few American firms are beginning, with imported workmen, to furnish specially designed eyes to suit unusual sockets, as well as eyes specially painted and prepared to imitate exactly the fellow eye. The ordinary protheses, as generally employed, are the old shell-eyes very little changed or improved during the past 100 years, and the new "*Reform-Auge*," the larger, thicker, solid or hollow eye, introduced by Snellen. The latter has the advantage of filling more completely the conjunctival sac, of pushing forward the upper cul-de-sac and so removing the sunken appearance (less easily remedied by the shell-eye) at the superior margin of the orbit. The effect of the Snellen eye is to produce a better prothesis; in most cases the eye stands out well. One of the purposes, also, of the "Reform" eye is to render needless such operations as that of Mules, Fox and Lang—the introduction of sponge, gelatine, globes of glass, metal or other foreign substance into the vitreous or orbital cavity or Tenon's capsule for the purpose of forming a more prominent or a better stump for the superimposed artificial eye. There are cases, of course, in which even the thickest Snellen eye cannot take the place, in this respect, of some one of the above mentioned procedures but, on the other hand, a specially prepared "*Reform Auge*," suited to the case in hand, will go far to imitate the prominent globe or the receding orbital walls of the opposite eye.

### Shells to Prevent Symblepharon.

Apart from the ordinary uses of the artificial eye it must not be forgotten that glass and porcelain shells are occasionally employed to good purpose to *prevent symblepharon* after wounds, burns and operations on the lids. These are of two kinds; one sort, almost exactly like the artificial shell but adapted to the particular requirements of the case; a second variety, like the first, only pierced with a central aperture for the protection of the cornea, to permit the escape of secretions and to allow the entry of collyria to the globe and sac.

### Shells for Conical Cornea and Irregular Astigmatism.

Other artificial shells, called by the Frenche "*contact glasses*," of transparent glass, were adjusted closely to the eyeball and were recommended in irregular astigmatism and keratoconus to give a regular contour to the front of the cornea and so improve the visual powers and cosmetic appearance of the eye. In some cases there was a space between the outer layer of glass and the cornea (or the shell was hollow) to be filled with a 50 per cent. glucose solution which is of the same refractive index as the cornea. Sulzer\* found these non-irritating and of great benefit in improving vision. About 1871 Albini\*\* invented a plate or cover of aluminum for the front of the eye, to be held in place by the lids. He called this device an *opisthoblepharos* and claimed that it is useful (a) in *staphyloma corneæ* upon which it might exercise beneficial mechanical pressure; (b) to protect the bulbar conjunctiva from cauterants applied to the lids; (c) as protection to the cornea in ulceration of the latter; (d) when covered with a certain composition it would take the place of the artificial eye; (e) it might act as a frame to carry minute quartz lenses and thereby be a substitute for ordinary glasses; (f) it might be useful as an electrode in applying electricity directly to the globe. Few of these claims have been justified in practice.

### Composition of Artificial Eyes.

The vitreous prostheses of the present day are made of enamel (a fusible, opaque mixture of silicon, potash, lead and tin) colored with various pigments; they are not prepared of ordinary glass as was once the case.

### The Functions and Advantages of the Artificial Eye.

Pansier† sets forth the advantages of the artificial eye from the social and commercial side. For the well-to-do it conceals what would otherwise be a terrible disfigurement; for the poor man it also serves

\*Sulzer. *Annales d'oculistique*, Vol. 107, p. 321.

\*\*Albini. *Annales d'oculistique*, 1871, p. 188.

†*loc. cit.*, p. 44.

to conceal what would infallibly prevent him from obtaining most kinds of work, since nobody cares to engage an artisan who presents the appearance of having but one eye.

The functions it subserves from the medical side are several. (1.) It regulates the movements of the lids. The upper lid deprived of its support by the loss of the eyeball, falls flat and flaccid; it sometimes turns in because the contracting marginal fibres of the orbicularis have nothing to oppose their action. (2.) The artificial eye relieves the friction of the lashes upon the lining of the sac due to this form of entropion. (3.) The artificial eye directs the drainage of the sac, especially of the tears. (4.) It protects the walls of the cavity from infection and from foreign bodies. (5.) When the prosthesis is worn over a globe still sensitive to light-impressions, the artificial eye may serve to cut off the light rays that, in some instances, are a source of acute annoyance to the patient. (6.) *In children a large sized, well-fitting eye is a necessary stimulant to the development of the orbit and face.* Deprived of the globe the infantile orbital cavity on the affected side does not increase *pari passu* with its fellow. The prosthesis prevents to a large extent this one-sided growth provided, always, that the artificial eye is as large as possible and is almost constantly worn.

#### **An Artificial Eye May be Worn at a Very Early Age.**

Practically whenever an eye is removed its place may be taken by an artificial one. Pansier\* ordered a prosthesis for an infant 18 months old, and cases where they were worn at 2 and 3 years are not uncommon.

After an enucleation the artificial eye may be fitted as soon as the wound of operation has fully cicatrized. There can be no fixed rule, but the adaptation of the prosthesis should not be deferred too long or done too early. An average period of four weeks is about right, although Klaunig, Galezowski and other believe that 14 days is generally long enough to wait.

When adjustment of the artificial eye is too long delayed the lid tissues contract, the cul-de-sacs diminish in depth and there is some difficulty in adjusting an eye that is large enough, that is satisfactory to surgeon or patient or that, sometimes, is easy to retain in its proper place.

*After exenteration of the orbit, especially if any portion of the lid tissues has been involved in the operation, it is extremely difficult to fit a prosthesis that will produce a satisfactory cosmetic effect. Since*

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\**loco. cit.*, p. 48.



the introduction of the Snellen eye and the possibility of having artificial eyes specially made and adjusted by competent artisans this difficulty has, in a measure, been overcome. Still, the adjustment of a prosthesis after an extensive orbital exenteration remains very unsatisfactory and the majority of patients prefer to cover their deformity with a skin-colored shade—preferably of celluloid—adjusted closely to the orbital margins, rather than wear an eye that fails to disguise the defect.

An artificial eye can generally be worn with satisfaction over an atrophic globe or one from which the intraocular contents have been removed. When the cornea has been preserved it is well to order an eye whose *margins* mainly support the prosthesis, thus preventing as far as possible undue pressure on the sensitive corneal surface. There are cases in which sympathetic irritation has appeared in the fellow eye—a condition commonly calling for complete enucleation. It is even possible that an ill-fitting, or even a properly adjusted shell may light up a cyclitis in the underlying globe, an inflammation capable of transmission to the opposite eye.

#### **Requirements of a Properly Adjusted Prosthesis.**

The eye, whether it be a shell or a Snellen eye, should exactly resemble the fellow eye in coloration of the sclera and iris, size of the cornea, tint of the sclera, medium dilation of the pupil in the appearance of anterior chamber, position of the visible blood vessels, location of the cornea, and convexity of the globe. Its size should conform as nearly as possible to the conjunctival cavity and orbit. In people with sensitive orbits I am in the habit of introducing at first an eye somewhat smaller than the one I expect them to wear finally. After an interval of a few weeks I adjust the permanent prosthesis. It may be put down here that the patient, if he can afford it, ought to be supplied with at least two such permanent eyes in case one is lost or broken. When these eyes are specially made for him two should be ordered.

Artificial eyes should be perfectly polished, and without defects; especially should they be free of those pin-point airholes in the glaze one occasionally sees in the cheaper grades of prostheses which are likely to harbor secretions that in a short time render the surface rough and irritant.

In passing, it may be noticed that worn, scratched or roughened artificial eyes may be polished and their life of usefulness extended, although the newly polished surface does not endure as long as the original glaze.

The edges of the prosthesis ought not to be too thin—at least a



millimetre thick—nor should the body of the eye be too delicate; it is then easily broken.

That the very particular patient may be prepared for most contingencies he should have two differently colored artificial eyes, one with a comparatively small pupil for using during the daytime, when he is exposed to a full illumination and the pupil of the healthy eye is somewhat contracted, and the other, with a larger pupil, for evening wear when the pupillary expansion of the seeing eye is greater than during the daytime.

#### Shape and Size of the Prosthesis.

The artificial eye must necessarily be adapted to variations in the capacity, depth and height of the conjunctival cavity. As a rule, however, the cornea is placed below the horizontal line (because of the greater depth of the superior fornix and width of the upper lid) and towards the inner canthus, where the narrow part of the eye is adjusted. It thus follows that the right eye will not generally receive a prosthesis intended for the left socket, and *vice versa*. This is, however, not always the case; indeed, Boissonneau sold an "*oeil symétrique*," to fit either side, but it was not a very satisfactory device.

Vendors of artificial eyes generally keep a few on hand for such anomalies as symblepharon, partially obliterated or contracted sulci, cicatricial deposits on the floor of the orbit, atrophic globes, etc., but the variations in these respects from the average socket are so numerous that it is generally difficult to secure an accurately fitting prosthesis from even a very large stock; it is much better to secure the services of a competent artisan, who will make a prosthesis for the particular case.

Pansier's test of a properly adjusted artificial cornea is chiefly that when the patient fixes a point three metres distant the optic axes should both appear to cut that point. That is to say, for the distance there should be a slight, apparent convergence. Better a decided convergence than the slightest divergence. He also believes that the *mobility of the prosthesis* depends as much on its perfect adaptation of the lids and stump as to any other consideration. He prefers the Bonnet method of leaving the musculature intact, a fact long ago observed by my confrere, Frank Allport, who sutures the tendons of the straight muscles at the medial incision, thus obtaining the fullest effect of their action upon the ocular pad, whether it be that resulting from a Lang's operation, an abscission, or an ordinary enucleation.

The reader is reminded that a very effective method of measuring the excursions of the artificial eye is to examine them with the á candle on the carrier of the perimeter, as in determining the angle of

squint. If this is done it will be noticed that the most extensive excursion of the shell is downwards, then inwards, then outwards, and least upwards, as Truc and others have demonstrated.

#### **Introduction of the Artificial Eye.**

This is generally quite simple. Holding the small end of the prothesis between the thumb and finger of the right hand, apply the thumb of the left hand to the eyebrow and raise the upper lid, at the same time asking the patient to look down. Introduce the larger end of the eye well into the upper sulcus. Remove the left thumb from the eyebrow. Rotate the prothesis on its axis so that the smaller end almost corresponds to the inner canthus. With the left fore finger draw down the lower lid; the artificial eye will slip into its place. Further adjust the prothesis by gently separating the two lids for a moment.

If the patient introduces his own eye he uses the left hand where the surgeon employs his right. As a matter of experience the patient soon learns not only to adjust, but remove, his own prothesis better than anyone can do it for him.

#### **Removal of the Prothesis.**

The majority of artificial eyes may be removed from the socket by drawing down the lower lid with the forefinger and at the same time pushing its point below the edge of the prothesis as it is felt beneath the lid-skin. The eye readily drops out over the margin of the lower lid. This manoeuvre failing, draw down the lower lid, insert the head of a pin beneath the lower margin of the shell at the inner canthus of the eye, and slowly pass it along towards the middle of the shell; the prothesis will be readily drawn out over the edge of the lid.

The patient can easily be taught both procedures and instructed to remove the prothesis over a cushion or other soft object, to avoid the danger of breakage.

#### **Care of the Shell.**

For the first week or two, or until the patient and his orbit become accustomed to the presence of what is to some extent an irritating foreign body, the eye should be worn only for a few hours daily. At first it may be kept in place for an hour at a time, say, three times daily, after which it can be worn for longer periods until it is eventually retained all day.

The prothesis should be removed on retiring at night.

I have a number of patients who, for various reasons—generally cosmetic—wear their prothesis day and night, and I cannot see that any harm has arisen from following this plan, but, as a rule, the wearer

should be told that it is conducive to the health of the parts to give the orbit a rest during the night.

After the removal of the shell at night the conjunctival sac should be washed out with a warm, saturated solution of boric acid, or with any other simple detergent wash, and the lid edges should be similarly cleansed.

#### **When Should the Prosthesis be Changed?**

The materials (enameled glass and glaze) from which the artificial shell is made, undergo chemical changes as the result of friction with the lid edges and exposure to the secretions from the conjunctiva. For this reason it is a mistake to add to these sources of deterioration by keeping the prosthesis in solutions of any kind—even water—over night. The eye should be cleansed with warm water in which a little baking soda has been dissolved, wiped perfectly dry with a soft, clean and old linen or cotton handkerchief or towel, polished and placed in a small box to protect it from dust until it is ready for use in the morning. Treated in this way it ought to last for one or two years. As soon as it loses its pristine polish, or sets up irritation about the orbit, or loses its motility, or looks as if it were too small or too large, it ought to be changed. The most sensible thing for the patient to do is to return to the oculist every six months for the purpose of having his artificial eye and the socket critically examined; if any change is called for, the surgeon is more likely to perceive it.

#### **Inconveniences and Dangers of the Artificial Eye.**

Although, in most instances, the prosthesis masks an evident defect, protects the socket and its lining, and insures proper drainage of the eye, there are some possibilities of danger that inhere in the wearing of the shell, especially if it is not carefully selected, properly adjusted and duly cared for.

The depression below the upper margin of the orbit (which is always more or less marked after enucleation or evisceration) is due chiefly to the contraction of the *levator palpebræ superioris* that in the absence of a globe of normal size pulls the upper edge of the tarsus (into which it is inserted) directly backwards instead of upwards over the eyeball, as it usually does. In his anxiety to correct this part of the deformity, the surgeon (more frequently the optician) may introduce too large a prosthesis, especially if it be of the flat type of artificial eye. This act results in the inordinate stretching of the parts, discomfort to the wearer and interference with the proper movement of the lids.

Several observers have recorded instances of damage to the socket

and the remaining eye as the result of the introduction and attempted use of too large or an ill-fitting shell. Among these are *sympathetic irritation*, *migratory ophthalmia*, *obliteration of the cul-de-sacs*, *atrophy of the lid muscles*, abnormal stretching of the lid skin, *symblepharon*, *chronic catarrh of the conjunctiva* and *epiphora*.

If the depression caused by the action of the levators is not remedied by the artificial globe, there are several operations (those of Critchett and deWecker, for example) to which one may have recourse, although it may be said in passing that the Snellen eye, as well as the specially constructed shells, have much reduced the proportion of these defects.

#### **Obstacles to Wearing an Ocular Prosthesis.**

Most of these have already been mentioned, but it is as well to repeat some of them. As a general rule, when the sac is for any reason too small to admit an artificial eye, it will require, and may, as a rule, have a satisfactory operation performed upon it.

Conjunctival bridles may be incised, and conjunctival symblepharon treated, while even total adherence of both lids and obliteration of the sac may be remedied in consequence chiefly of the labors of American surgeons—notably Weeks and Hotz.

In some cases the artificial eye, acting as a foreign body, sets up or perpetuates a previously existing conjunctivitis, or encourages exuberant granulations along the line of incision. Especially in the case of the shell eye, it may prolong an original vice of the conjunctiva by preventing the escape of secretions. This is especially true of that variety of artificial eye that has a rounded margin with an opening, however large, into the body of the prosthesis. The concavity holds fluids that readily undergo decomposition. If the borders or surfaces have been eroded, or have lost their polish, this is all the more likely to happen. It is needless to point out that the eye should not be again worn until the disease has been cured, and that no prosthesis should be kept in place that has not perfectly smooth surfaces throughout.

#### **How to Order an Ocular Prosthesis.**

If the surgeon lives in a city and can send his patient directly to the optician, so that the coloration, prominence and other characteristics of the remaining eye may be noted and a selection of, say, twenty prostheses returned, that a properly fitting shell can be chosen, it is, of course, the best plan to adopt; but if patient and surgeon reside at some inconvenient distance from the vendor of artificial eyes, some other course must be pursued. To meet this latter difficulty, numerous suggestions have been made and carried out—such as the preparation of models in wax, paraffin, soft tin, lead or aluminum; or of

gutta percha softened in hot water, or carving them out of such materials as ivory, wood and bone. As for the coloration of the remaining eye it was either described or a painting of the eye in pastels or oils accompanied or formed part of the model; or a large photograph was taken of the eye properly colored.

In addition, the diameter of the cornea, the length and height of interpalpebral space, the average width of the pupil, the coloration of the conjunctiva and the distribution of its vessels, the degree of bulbar prominence and other necessary details were written upon the photograph. As a matter of practice nowadays, most wholesale opticians issue blanks upon which the surgeon writes the information just referred to, as well as a record of other necessary details. On the arrival of a selection of shells he proceeds to choose from the consignment and adjust a properly fitting eye.

#### **Varieties of Artificial Eyes.**

Owing to the fragile character of enamelled eyes, many substitutes have been proposed. These have been chiefly prostheses of *lead*, *aluminum*, *ivory*, *bone*, *caoutchouc*, *vulcanite* and *celluloid*.

Nieden and van Duyse devised prostheses of which the body is made of material not readily broken, with a superimposed enamelled iris and cornea. The substitutes (of French manufacture) that I am best acquainted with, are made of celluloid, but although much cheaper than the vitreous shell, are expected to last only a few months. Moreover, they lack the peculiar brilliancy of the enamel eye, their margins are thin and irritating, they readily corrode and lose their polish, and I do not believe their single virtue—freedom from danger of breakage—compensates for these defects. On the other hand, prostheses made by a competent workman, of enamel glass, resist the action of the tears and mucoid discharges from the conjunctival cavity, as well as damage from other sources of deterioration for one or two years.

Practically the same remarks apply to all other substitutes for eyes made of enamel glass. With a large supply both of the irregularly ovoid Reform prostheses, as well as of the older shell plates to choose from, not to speak of the possibility of securing the services of a competent artist to make and adjust artificial eyes to almost every unusual form of socket, no patient can complain that he cannot have a satisfactory companion for his remaining eye.

# CHAPTER XLVI.

## TREATMENT OF OCULAR HEADACHE.

*Importance and Frequency of Headache Due to Eye Diseases and Strain—Their Diagnosis of Much Interest—Exciting and Remote Causes—Partly Dependent Upon the General Condition as Well as Diseases of Other Organs—Correction of Refractive Errors and Muscular Anomalies—Local and General Therapy—Migraine Intrequently Due to Eyestrain.*

Few symptoms are of greater importance to the student or practitioner than headache, and none will more largely tax his diagnostic and remedial resources. Before he can properly decide to what class a particular headache belongs, he must have a practical knowledge of all of them. *Ocular headache may be defined as that acute discomfort in and about the head that directly or indirectly results from organic or functional disorder of the visual apparatus.*

*The ocular element in all forms of headache is larger than is generally suspected. It is probably not less than 40 per cent.; while of all bilateral, frontal headaches 75 per cent. are due to eye-strain.* In a previous chapter it was shown that the ciliary and other eye muscles always endeavor to bring about effective vision and that in abnormal states of the refraction, particularly, this constant effort results in symptoms, prominent among which is the headache in question. These attempts irritate not only the third nerve nuclei but the center for the trigeminus; the end filaments of the latter on the forehead suffer, so that there is not only a peripheral aching noticed by the patient but a duller pain referred to the eyeballs and the parts behind them. In the very chronic cases, also, the whole front of the head aches. The pains of eye strain are invariably bilateral.

The exciting cause of ocular headache is chiefly some form of near work that requires long continued use of the muscles of accommodation and convergence, such as reading, sewing, stenography, embroidery, drawing, painting, music, writing, cardplaying, type-writing, etc.

The *site* of the headache is very important. In the order of frequency this is supraorbital, deep orbital, fronto-occipital and temporal. *A unilateral, supraorbital headache or a hemicrania of any kind is not commonly due to eye strain.*



The *pains do not always follow immediately upon indulgence in excessive near work*; they are sometimes not noticed until the early morning. As a rule, however, the eyes and head commence to ache after a certain number of minutes or hours of close work with such regularity that the sufferer himself attributes it to some trouble with the eyes. Astigmatic, hypermetropic, and heterophoric patients also suffer when called on to use their eyes much for *distant* vision. An evening at the *theatre* or an afternoon in *shopping* is often responsible for an ocular headache, as these occupations reach the weak points in the ocular apparatus. In the latter case the necessity for keeping a lookout in all directions to avoid collisions with fellowshoppers in a crowded store, with pedestrians on the pavement and with men, women and vehicles on street crossings, the close examination of fabrics—often in a poor light—all these efforts make large demands not only on the general nervous energy, but particularly on the extrinsic and intrinsic muscles of the eye. When the latter are handicapped by muscular anomalies or refractive errors, the shopper usually goes home with a headache. In the same way, riding in a *railway-train* or *street-car*, with the moving panorama viewed from the car window, is especially trying to defective eyes. Doubtless *church, concert and theatre headaches* are also due to efforts by abnormal eyes to stare at distant objects, while the cerebral centers are meantime further irritated by rebreathed air and unshaded lights.

Along with the headache are almost always other signs and symptoms that proclaim the ocular nature of the trouble. After reading for a time, *lines and letters run together* or become mixed up. The conjunctiva of the eyeball gets red from hyperemia of its vessels and the lids burn, smart and itch.

It must not be forgotten, however, in the diagnosis of ocular headache, that the eye, so far as symptoms and the results of inspection go, sometimes seems to be free from disease. There is an ocular headache, but no apparent disease of the eye. A *patient may have a purely ocular headache although the vision is normal or even above normal, and although many of the asthenopic symptoms just detailed are wanting*. It is, strange to say, usually the person with unusually good distant vision, or who at twenty years old has had it, that complains of eye-strain. The short-sighted person cannot distinguish objects in the distance, but he does not often suffer from headache.

*Imbalance of the extrinsic muscles* (heterotropia, heterophoria), (see the chapter on this subject, in association with refractive anom-



alies) is also a cause of ocular headache, and it is always desirable to apply the tests for this condition in the diagnosis of eye-strain.

The general practitioner must bear in mind that *supraorbital headache also results from several forms of nasal "catarrh."* Hypertrophic rhinitis, deviations of and growths from the septum, polypi mucous and purulent collections in the various sinuses all produce frontal headaches. The chronic, frontal headache of nasal disease differs from ocular headache in that the former continues during the night, or gets worse when the patient takes "cold," while a purely ocular headache is not usually made worse by a simple coryza and ceases when the patient has retired and the lights in his room are extinguished; in other words, there is no headache when there is no ocular strain. (See, also, the Chapter by Dr. Frank Brawley).

The various forms of supraorbital neuralgia may usually be detected by their periodicity, by the tenderness at the supraorbital notch and soreness of the skin along the course of the nerve, by their being almost always paroxysmal and unilateral and by the absence of asthenopic symptoms.

A class of practically incurable ocular headaches is that arising from a combination of eye-strain, and organic disease of the retina, choroid, or ciliary body. The headaches from iritis, glaucoma, and other acute diseases of the eye, are to be recognized by the presence of the affections themselves, a short description of which is given in this System.

The treatment of ocular headache should be directed first of all to the relief of the eye-strain, especially the correction of the hyperopia, astigmatism or the accommodative anomaly, by means of glasses. Any local inflammation should be allayed; thus it not uncommonly happens that diseases of the lids may prevent a complete cure of the headache even after a correction of all refractive and muscular errors.

It should also be borne in mind that any departure from health may affect the eye and so act as a predisposing cause of ocular headache. Prominent among the conditions that intensify or invite ocular headache is *insomnia*, whatever be its origin, and one may be well assured that complete relief from the chronic pains in the head is very uncertain if the patient's sleep be disturbed or insufficient, even if the other factors in their production receive proper attention.

*Dyspepsia* in all its forms, but especially the toxic form, due to too much eating and too little exercise, is a frequent accompaniment

of frontal headache and should receive quite as much attention as the purely ocular symptoms.

*Excessive indulgence in tobacco and alcohol* among male patients, and tea and coffee among female sufferers, should not be overlooked.

Of *local applications* the simplest, most effective and least harmful is the use of very hot or very cold fomentations. The patient may be allowed to try both hot and cold water (q. v.), choosing the one that seems to him more useful or more grateful. Take a medium sized towel, folded to measure twelve inches long by four wide. Grasp an end in each hand and dip into a basin of cold (40° F.) or hot (130° F.-150° F.) water. Bending over the basin, press the dripping towel gently against the closed eyes, forehead and temples. Repeat the applications in this way every fifteen seconds for five minutes, stopping them if additional pain or discomfort be produced. Do this every hour, or oftener, while the headache lasts.

*Soothing collyria relieve the headache*, sometimes, by their action on the congested conjunctival vessels:

R

Boracis	
Acid. boracic.	āā ʒss
Aquæ camphor.	f. ʒss
Sol. adrenalin. (1:5000)	ad. f. ʒii

Drop into the eye every hour or two.

Another effective collyrium, to be used in the same way as the foregoing, is:

R

Chloreton.	0.10
Sodii boratis	0.50
Aquæ dest.	30.00

The headache may often be dissipated by using the following mixture, to be rubbed over the forehead and temples; or a towel, wet with one part in ten of ice water may be laid over the closed eyes, and over the forehead, while the patient is lying down:

Spirit of lavender, alcohol, of each 3 fluid ounces; spirit of camphor, 1 fluid ounce.

The following liniment is also effective:

R

Chloroform.	f. ʒi
Spts. camphor.	
Tinctur. aconiti	āā f. ʒii

Ol. menth. pip.

gtt. xx

Alcohol.

f. ℥ii

Shake well and apply *to the temples and forehead only* every two or three hours.

*Temporary relief of the pain* may usually be obtained by the use of a *weak, interrupted (or continuous) galvanic current*, 3 to 5 ma., the positive pole applied to the nape of the neck, the negative, preferably by means of a double eye electrode, to the closed lids, for from two to ten minutes. (See Dr. Coleman's Chapter on the Use of Electricity in Ocular Therapy.)

Theobald (*Text-book*, p. 515) prefers the *oleate of veratrine* (q. v.) in 10 per cent. strength to any other preparation of the kind in the asthenopia and *frontal headache* of accommodative strain. He also finds that it lessens the irritability of the ciliary muscle preparatory to testing errors of refraction. A little is to be rubbed upon the forehead and temples once a day, preferably in the morning. None of it should be allowed to enter the eye as it causes severe and persistent irritation.

For the *temporary relief of headache* and as an adjunct to other treatment J. A. Donovan (p. c.) finds full doses of the fluid extract of cannabis indica and fluid extract of hyoscyamus to be of especial value.

For the relief of the *minor results of eye-strain* James A. Spalding (p. c.) advises the following prescription, especially for twitching of the eye-lids, a sensation of discomfort about the eyes, in the forehead or temples:

R

Etheris sulphuric.

15.00

Spirit. rosinarini ad.

60.00

This mixture is to be applied to the lids with the tip of a finger; the lids are then to be kept closed for a brief period of, say, ten seconds. It may be used as many as three times daily. If one feels "tired in the eyes" after reading, or on waking in the morning it is an excellent lotion, care being taken to keep the lids closed, to keep the mixture out of the eyes where it will smart a bit.

Alexander Randall (p. c.) believes that eserine is very effective when used in asthenic conditions and when the anterior perforating veins are engorged. He prescribes a very weak solution—1/10 of a grain to the fluid ounce (0.20 per cent.), or less.

#### Migraine.

*Scintillating scotoma. Amaurosis partialis fugax.*

The attacks of this disease have certain clinical affiliations with

epilepsy but are *not to be regarded as indicative of disease of the eye*, although ocular disturbances form an important part of the symptom-complex. Apart from the scintillations, a "fortification" scotoma is the most common experience. This irregular, cloud-like appearance, usually edged with colors, shows itself in some part of the visual field and gradually spreads until the patient is blind. This is followed in its turn by severe, unilateral headache, lasting for a few hours or for a whole day, to be apparently relieved by vomiting. *The attacks of migraine become less frequent or less violent after 45. until they generally disappear, with advancing years.* The elasticity of the vascular walls diminishes with age, thus interfering with that spasm of the cerebro-cortical vessels upon which the disease probably depends. As in epilepsy, *treatment* (especially the prescription of glasses) *directed to the eye occasionally relieves or cures this troublesome affection, but it is not to be relied upon.* (See D'Orsay Hecht's remarks on the subject in this work.)

## CHAPTER XLVII.

### NON-OPERATIVE CONDUCT OF OCULAR INJURIES AND SYMPATHETIC DISEASES.

*Injuries of the Eye in General—Microbic Infection to be Feared After Every Abrasion or Wound of the Ocular Coverings—Penetrating Wounds and Their Treatment—Foreign Bodies Within the Globe—Destructive Ulcer of the Cornea and its Sequels—Sympathetic Irritation—Burns of the Cornea and Conjunctiva—Sympathetic or Migratory Ophthalmia—When Shall an Enucleation or its Substitute be Done?—Medical Treatment of Sympathetic Diseases.*

#### OCULAR INJURIES.

Although traumatism of the various parts of the eye has been generally discussed in this System from the standpoint of non-operative treatment, the following review of Lange's work, copied from *The Ophthalmoscope*, Feb., 1908, is so much to the point and so well written, that I make no apology for reprinting it here.

The author\* in a short but instructive treatise, points out that since the advance of our knowledge in regard to aseptics and antiseptics, considerable improvements have been made in the treatment of traumatisms of the eye, and he proposes to lay down some general principles that may serve to guide the practitioner in dealing with accidents before they are seen by the specialist.

Every wound, even the most superficial, should be regarded as infected, and should, as far as possible, be purified by the use of disinfectants. The edges should be so applied that a linear cicatrix may result. Every endeavor must be made to prevent the wound from coming into contact with the conjunctival fluids, which so constantly contain the virulent pneumococcus as well as occasionally other organisms, such as the staphylococcus pyogenese albus, the streptococcus pyogenes, the diplobacillus of Morax-Axenfeld, and the Löffler's diphtheric bacillus. With this object in view, careful examination should be made of the tear passages. If the slightest discharge from the puncta lacrymalia be observed, the ducts should be submitted to careful and thorough injection and sounding, and if the lachrymal sac present signs of chronic discharge, it should be at once extirpated. If

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\**Ueber Behandlung von Augenverletzungen.* Halle, 1908.

objection be raised to this by the patient, the punctum should be touched with the galvano-cautery, so that it may no longer be a channel of communication between the conjunctival and lachrymal sacs."

"The cleansing of the conjunctival sac, and especially of its upper fold, is imperative, and the best solution for the purpose is the *oxycyanide of mercury* (q. v.) in proportions varying from 1:3,000 to 1:1,000, which is only slightly irritating. The surface may then be lightly brushed over with a plug of cotton wool, sterilized and moistened with the solution, care being taken to avoid any injury to the epithelium. A sterilized gauze bandage, except in cases of deep burns, should, finally, be applied without pressure."

"The more serious forms of injury of the eye are cuts or *penetration into the interior of the globe* by foreign bodies; wounds made with pointed instruments; injuries, such as contusions inflicted with blunt objects; and, lastly, burns and injuries inflicted by chemical agents."

"The treatment in the case of all foreign bodies is to effect their complete removal without doing more harm to the eye than is absolutely necessary. The instillation of a drop of a 2 per cent. solution of cocaine facilitates the removal of small as well as large objects which, after eversion, are often found adherent to the inner surface of the upper lid, or lodged in the upper conjunctival sinus."

"In cases of impaction of *sparks from forges*, not only the particle of iron, but the stained or carbonized ring of the cornea around it should be removed. Metallic fragments imbedded in the cornea are best removed by means of a powerful magnet. After any of these proceedings, the cornea should be washed with the mercury oxycyanide solution. Lead washes should never be employed."

"Central opacities, it should be borne in mind, may easily reduce the sharpness of vision to one-third, or even to one-sixth, of the normal degree. *Prolapsed portions* of the iris are rarely completely and satisfactorily replaced, and, as a rule, all such parts of the iris, ciliary body, choroid, retina, or of the vitreous *should be removed* before the external wound is closed, for there is great danger that even after short exposure, the prolapsed portion, if replaced, will carry with it some germs or micro-organisms."

"*Splinters of iron*, when their position can be ascertained with accuracy by means of the sideroscope, can be removed with the magnet by making a fresh cut, and in the case of fragments of copper, the same proceeding may be adopted and a pair of sterilized forceps carefully introduced through the new opening.

"Lange records a case where a fragment of *iron lodged in the retina* after perforating the iris. The *treatment* adopted was thorough disinfection of the conjunctiva, rest for six weeks (on the back chiefly) in bed, atropine to prevent traction by the ciliary muscle, and a binocular bandage (although the patient had lost the use of the other eye.) There were no ill effects, except the presence of a small scotoma and the temporary lowering of the visual acuity to  $2/3$ . When seen after the lapse of seven years, vision was normal, and although the body could still be seen, it had excited no inflammatory reaction. Foreign bodies sometimes partially or completely traverse the globe, in the former case the precise condition being difficult to establish, but experience shows that enucleation is the most appropriate treatment."

"*Cilia and other hairs*, as those of the "procession caterpillar," are sometimes carried into the interior of the globe and should be removed as soon as practicable, as they set up a form of inflammation named by Saemisch "*ophthalmia nodosa*," (q. v.) due to the formic acid each hair contains. Sharp and pointed objects may scratch, cut, or puncture the globe, and each of these forms of injury may inflict a superficial or a penetrating wound."

"Scratches of the cornea, as with the nail of the finger, often recover quickly and completely, but sometimes present the symptom of recurring acute nocturnal pain. In such cases, cocain appears to be harmful rather than otherwise, and a 2 per cent. solution of silver nitrate is more effective in relieving the pain. Under unhealthy conditions, the much-dreaded *ulcus corneæ serpens* may arise, as Uhthoff and Axenfeld have shown, and this is particularly likely to occur in scratches with the beard of grain, as of barley. In such cases, Lange has found the *application* of the *galvano-cautery most effective*, at the same time disinfecting the conjunctival sac with vaseline containing one per cent. corrosive sublimate. Römer's method of treatment with the pneumococcus serum has not proved useful in his hands. Yeast serum requires further trial. Large serous cysts sometimes form after abrasions, which Lange names "implantation cysts," removable by excision. Deep cuts and punctures often lead to loss of the eye. Contusions may lead to rents or to partial detachment of the iris, and consequent irido-donesis, or to hemorrhages and to dislocation of the lens or to rupture of the sclera, which sometimes occurs at the opposite pole of the eye or to commotio retinæ."

#### Penetrating Wounds of the Eyeball.

Donovan\*, who has had a wide experience of these injuries, be-

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\**Journal A. M. A.*, July 25, 1908.



believes that enucleation is performed too frequently and without sufficient deliberation. The fact that injuries of the eye are frequent in lower animals while sympathetic ophthalmia is unknown, proves that many cases could be treated expectantly without danger. Many eyes are lost through meddlesome surgery. Donovan suggests the following routine:

1. Mild antiseptic cleansing with 1:5,000 iodide, 1:2,000 cyanide, or 1:5,000 bichloride of mercury, or with saturated boric acid solution. Argylrol should be employed in special cases.

2. Extract all magnetic foreign bodies at once; also any that can be removed more easily and safely than later on. Those remaining are to be removed from time to time when the eye can safely stand interference.

3. Enucleate at once only such eyes as have been totally destroyed, waiting until the fourth day to make sure. Others should be cleansed, filled with salt solution if collapsed; prolapsed iris should be replaced or cut off.

4. Cauterize infected wounds; use stitches when the lids will not hold edges in apposition; atropine and dionine as indicated. Hot applications are always safe and usually preferable to cold.

5. Keep the patient in bed, if possible, as detachment of retina may have occurred. Finally, never interfere with an eye until you feel reasonably certain you are now doing the best thing, and at the best time; otherwise always wait. In the discussion of this paper attention was called to the danger of delaying enucleation in hopelessly injured eyes, the importance of early enucleation in preventing sympathetic inflammation—a disease limited to man.

#### **Burns of Eye.**

Ovio (*Clinica Oculistica*, Aug., 1905) has drawn our attention to the severity and chronicity of burns from chemical caustics. They are frequently fatal, although they seem at first to be merely superficial and trivial. Burns from acids are much less serious than from alkalies. The relatively benign nature of burns from hot metal, seems to be due to the liquid which bathes the front of the eye; it either cools the metal rapidly, if it be in small mass; or, during vaporization, takes a spheroidal shape, if the mass be large, and holds it away from the eye. The great danger from chemical caustics is that they penetrate the tissues more or less deeply, and cause more or less complete local death. Acids harden and contract the tissues, thus limiting their own action; alkalies, on the other hand, soften and infiltrate. Organic acids are more destructive than mineral acids, to organic tissues, because the latter do not harden, but behave rather like alkalies in respect

to the infiltration and swelling. The most dangerous alkalies are potash and lime. Ammonia has a peculiar reaction: the tissues seem uninjured at first, but in a few days the cornea ulcerates, and may become permanently opaque. Alcohol and ether do little damage; chloroform and tincture of iodine are more dangerous; of antiseptics the most destructive is corrosive sublimate.

### SYMPATHETIC OPHTHALMIA.

*Migratory ophthalmia. Transferred ophthalmitis. Sympathetic irritation.*

It is in the stage of *sympathetic irritation* that most good can be done by *non-surgical treatment*. To this end, *large doses of sodic salicylate*, after the method described by Gifford (q. v.), should be tried at once. In addition, potassium iodide, with or without mercurial inunction, intravenous subconjunctival or subcutaneous injections and the employment of sweat baths must be borne in mind.

Whether the symptoms excited in the fellow eye are or are not always a possible forerunner of migratory ophthalmia, the probable cause of the *sympathetic irritation* should be found, and, if possible, removed. The injury to or disease of the exciting eye should be skillfully treated. The patient ought to lie up and be treated in a hospital. The sympathizing eye is generally relieved by atropia, a shade and confinement to a darkened but well ventilated room. If he leaves his room he should wear tinted goggles or an eye shade. His diet should be regulated, his bowels kept freely open, and the necessary attention paid to the welfare of the exciting disease.

As it has very rarely happened that sympathetic *ophthalmia* sets in the fellow eye sooner than two weeks after the disease or injury in the exciting eye, the surgeon may feel that he is safe in employing prophylactic and simple measures for that length of time before considering enucleation or some of its substitutes upon the excitant.

The treatment of all serious wounds and injuries, surgical and other, is generally of prime importance, while the conduct of traumatisms capable of exciting a migratory ophthalmia cannot be overrated. It is in this connection, also, that the question of the *removal of the exciting cause*, particularly the performance of enucleation or some substitute for it upon the exciting eye, etc., is always in order.

When the treatment just outlined is not effective, and evidences of sympathy are still present, the question of the removal of the exciting eye arises—especially if the fourteen days of grace have elapsed. The rules laid down by de Schweinitz (*Text-Book*, pp. 427, 428), based upon the experience of Swanzy and Schirmer, form a safe guide

in this regard: "Enucleation, or one of its substitutes should be performed on—

1. An eye with a wound so situated as to involve the ciliary region, and so extensive as to destroy sight immediately, or to make its ultimate destruction by inflammation of the iris and ciliary body reasonably certain.

2. An eye with a wound in this region already complicated by severe inflammation of the iris or ciliary body, even if sight is not destroyed; or an eye containing a foreign body which judicious efforts have failed to extract, and in which severe iritis is present, even if sight is not destroyed.

3. An eye, the vision of which has been destroyed by plastic iridocyclitis, or one which has atrophied or shrunk, provided there are tenderness on pressure in the ciliary region and attacks of recurring irritation; or without waiting for signs of irritation.

4. An eye, the sight of which has been destroyed, even though sympathetic inflammation has begun in the sympathizing eye, in the hope of removing a source of irritation, and thus rendering treatment of the second eye more effectual.

5. An eye in which the wound has involved the cornea, iris or ciliary region, either with or without injury to the lens, and in which persistent sympathetic irritation in the fellow eye has occurred, or in which there have been repeated relapses of sympathetic irritation.

6. An eye either primarily lost by injury or in a state of atrophy, associated with signs of sympathetic irritation in the fellow eye.

It is universally conceded that the enucleation of an eye primarily injured, the visual function of which cannot be restored, is the surest way of preventing sympathetic ophthalmitis. It is to be remembered, however, that even a very early enucleation does not necessarily prevent sympathy in the fellow eye, because the infective process may have begun before the operation, and may not develop for several weeks."

*Enucleation and several of its substitutes* may be performed under local anesthesia (q. v.). A successful method is that of A. Loewenstein, who induces *regional anesthesia by the injection of cocaine in the neighborhood of the lenticular ganglion* with the object of reaching the long and short ciliary nerves. The ganglion, as is well known, lies on the outer side of the optic nerve near the apex of the orbit. It may be reached by a strong needle, 5 cm. in length, pushed along the lateral wall of the orbit for a distance of 4.5 cm. From 1½ to 2 syringe-fuls of 1 per cent. cocaine, with a little adrenaline are injected in the vicinity of the lenticular ganglion, and the eyeball and the

surrounding parts are rendered anesthetic for a short time. Half an hour before this injection one-sixth of a grain of morphia is given *subcutaneously* to quiet the patient and calm his fears. Loewenstein has painlessly performed eighteen enucleations and seven exenterations under this form of ganglion-anesthesia.

The *treatment of sympathetic ophthalmitis* is quite another matter. Here surgical interference is rarely necessary. *Local treatment should be extended to both the excitor* of the ophthalmia as well as to the sympathizing eye. The latter should have atropine, dark glasses and complete rest at once, and the treatment just laid down for sympathetic irritation should be thoroughly carried out. In addition to the suggestions made under that heading (q. v.) *aspirin* may be substituted, in 15 to 20 grain doses four or five times a day, for the salicylate of sodium if that drug does not agree with the patient.

S. J. Bumstead (p. c.) in this disease, as well as in *cases of uveitis, following severe traumatism to the eye*, finds the sheet anchor to be *sodic salicylate* and *iodalbin*. There are still those who do not know how to give sodic salicylate so that the patient may take it for one or two months without toxic symptoms. This can be done in the following mixture:

℞

Sodii salicyl.

5 vi

Aquæ dest.

Tinct. gent. comp.

āā f. ʒii

One or two teaspoonfuls every three hours.

This mixture soon relieves the pain and will often cause the disappearance of deposits in the vitreous and anterior chamber. Since using iodalbin, which, in his opinion, is preferable to potassium iodide, he has alternated the use of these two therapeutic agents.

Abadie (*Ann. d'Oculistique*, 139, p. 409, June, 1908) considers that in the presence of *sympathetic ophthalmia* the exciting eye should not be removed unless its vision is quite destroyed. In cases in which the injured eye retains its normal shape and size, and has still a little vision, he cauterizes the wound very thoroughly and *covers it with a flap of conjunctiva*. He finds that this is at times sufficient to cure the sympathetic disease, but if it is not, he has recourse to mercurial inunctions and injections, reserving enucleation as a last resource. He considers that late cases are due to incomplete healing of the wound, with absence of protecting epithelium, and recommends the same treatment for them.

Burton Haseltine (p. c.) has used *subconjunctival injections of oxycyanate of mercury* in three cases of this disease with better re-

sults than could have been reasonably expected from other forms of treatment. From three to five drops of a 1-2000 solution were injected into the sympathizing eye every two, three or four days, according to the severity of the symptoms.

With this therapy the care of the injured eye, if not removed, should go hand in hand. In that case such intraocular medication as Haab's *iodoform rods or discs*, washing out the anterior chamber with 1:5000 mercuric chloride or 1:10000 formalin has also been recommended. The use of *dionin*, to its fullest effect, as well as *counterirritants*, like *Credé's* ointment, should be borne in mind.

It may be stated, in considering the therapy of the eye in which sympathetic disease is fully manifest, that perseverance with the internal use of *salicylates*, *iodides* and *mercurial inunctions*, alternated by or coincident with a sustaining and tonic regime, often gives results that one at first could not apparently hope for. Pain should be met with as few opiate doses as possible.

Eventually—perhaps after the lapse of months—when the sympathizing eye has become quiet, several discissions, or other procedures, may still further improve vision in the much damaged eye.

H. V. Würdemann (p. c.) introduces 50 *per cent. argyrol solutions* into the anterior chamber through corneal incisions, or wounds, and has thereby saved many eyes.

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## CHAPTER XLVIII.

### PREPARATION OF THE PATIENT AND SURGEON FOR OPHTHALMIC OPERATIONS.

*The Preparation for Ophthalmic Operations Much the Same as that for General Surgery—Preparation for Major Operations—Attempted Sterilization of the Conjunctival Sac and Lids—What Shall the Surgeon Wear?—Disinfection of the Hands of the Operator—Sterilizing the Instruments—Position of the Patient During Operations—Anesthetics—The Care and Non-Operative After-Treatment of Normal Cataract Extraction and Other Major Operations on the Globe.*

#### Preparation of the Patient for Ophthalmic Operations.

Generally speaking, *the same rules that one follows in the surgery of other parts of the body apply with equal force to the ocular apparatus*, and much the same precautions ought to be observed on the part of the surgeon. Especially if he is about to open the eyeball he should himself be clothed and cleansed as if he intended to do a laparotomy. All the well known rules of asepsis and antiseptics should, with slight modifications, be observed in every ophthalmic operation.

As before stated, it is practically impossible to sterilize the eyeball and conjunctival sac, partly because of the favorable nidus for bacterial colonies presented by the retrotarsal folds, the follicles of the conjunctivæ, the lid edges and the lachrymo-nasal tract, and partly because the eye would be injured by antiseptics strong enough to act as effective germicides. It has been found that, on the whole, *mechanical lavage or irrigation with mild detergents or indifferent fluids* is the best antiseptic measure that can be employed. If we cannot safely kill, by means of powerful agents, the pathogenic bacteria that infest the ocular structures we can at least *reduce their numbers*, wash away their *toxins* and lessen their power for harm.

For example, Bach\* showed, years ago, that by thorough irrigation of the conjunctival sac and lid edges with warm sterile water, weak boric acid, sodium bicarbonate or normal salt solution one obtains not only effective asepsis but the eye, remaining unirritated, is in better form to repel bacterial invasion than if it were disturbed by strong germicides.

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\*Archiv. für Augenheilk., 33, 1896.

*In preparation for major operations* on the eye, particularly when instruments are introduced into the interior of the globe, as in cataract extraction, iridectomy, iridotomy, etc., it is well to prepare the ocular region the night before the operation. The eyebrow is shaved, the cilia cut off short and the skin about the orbit *scrubbed with an ethereal solution of soap* and warm water. The lids and lid edges are gently but thoroughly cleansed with cotton soaked in a warm, saturated solution of boric acid, the contents of the lachrymal sac are squeezed out, the lids everted and then, with the retrotarsal folds, irrigated with some mild, warm antiseptic, such as 1:5000 formalin, a 4 per cent. solution of boric acid, or a 1 per cent. salt solution.

Snellen (Graefe-Saemisch *Handbuch*, 2te Auflage,) advises washing out the canal and lachrymal sac with Anel's syringe, but I doubt the expediency or necessity of this procedure except in purulent infection of the tear passages.

*The nearest approach to complete sterilization of the field of operation, with least irritation of the eye structures* is attained by the use of an ointment suggested by J. A. White (see *White's Ointment*) twenty-four hours before operation. This bichloride mixture may, with advantage, also be used immediately after the operation, as an antiseptic dressing to the wound. I have never known it to irritate the ocular structures and it disappears by absorption a few hours after its application to the sac, which should be completely filled with it. Draw down the lower lid and apply it on a probe to the lower palpebral conjunctiva, the patient looking up meantime; or, the patient lying down, pour the warm and semi-fluid salve into the lower sac, thus exposed, with a sterile spatula.

A light, sterile, gauze bandage is now applied, not to be removed until half an hour before the operation next day, when *the cleansing process should be repeated*, the second bandage remaining on the eye until the moment of operation. If the eye *now appears unduly hyperemic*, or if there is any discharge present, it is well to postpone the operation. Lippincott advises that the nasal cavities, those frequent sources of ocular infection, *be sprayed with 1:1000 solution of potassium permanganate* on the two dressing-occasions just mentioned.

Although the *hands* of the ophthalmic surgeon do not come into contact with operative wounds to the extent they do in general surgery, yet it is best to avoid even the "appearance of evil" by careful disinfection. It is well understood that it is almost impossible to destroy all the bacteria and to remove all the toxic matter that lie in the hair follicles, behind the nails and in the dermal folds, but one may

serve all practical purposes by simple cleansing of the hands first and the use of disinfectants afterwards.

Wash the hands in the ordinary way for two minutes with green soap and warm water *until they seem clean*. Douche them under the hot water tap for another minute. Carefully clean the nails and wipe the hands dry with a sterile towel. Now, use a brush with more hot water and soap and give the hands and nails a thorough scrubbing for three minutes. Dry them again and immerse them in 1:2000 alcoholic solution of sublimate for one minute. Rinse them in sterile water. There are numerous other methods of ante-operative cleansing in vogue but this will be found as effective as any, and the disinfection will be followed by a minimum amount of roughening and cracking of the skin. Should the latter show itself a little "cold cream," or glycerine and gelatine solution will give relief. There are also numerous "hand lotions" for the purpose.

Some operators, like Frank Allport, wear rubber gloves, but others, like myself, find that they dull the *tactus eruditus*, which, especially in ophthalmic surgery, is of considerable value to the operator. If used at all they should be very thin and fit snugly the fingers and hand.

As for the *gown worn by the ophthalmic surgeon*, it should be long enough to descend to the ankles and should be *tightly buttoned, pinned or tied at the wrists*. It is not necessary for the surgeon to concern himself about the condition of that part of his anatomy that is not exposed and there is no reason why any part of the arm should be naked above the wrist-joint.

He should wear a head and mouth covering and he should come to the operating room with as *clean clothes* and body, and with as calm, cool and collected a state of mind as possible.

Many an awkward moment will be spared that surgeon who mentally marks the steps of the proposed operation in advance of its actual performance, and who personally inspects all the instruments before beginning his work.

J. L. Hayes (p. c.) suggests that four drops of *chloroform inhaled by the surgeon* with a shaky hand will steady his nerves if taken just before a cataract or other major operation.

#### **Sterilizing of Instruments.**

I am in the habit of boiling non-cutting instruments for ten minutes in a sterilizer and then keeping them in warm, sterile water during the operation. For disinfection of Graefe knives, keratomes and other delicate instruments I still prefer their immersion for 10 to 15 minutes in a 90 per cent. solution of phenol with 10 per cent. glycerine. They are then dipped in 50 per cent. alcohol or sterile water and transferred

to the operating dish, which is nearly filled with warm, boiled water. There they remain until used. I feel morally certain that boiling needles, small knives, etc., injures their edges and points. I may say that I have tried various other methods of disinfection—boiling with soda, immersion in one per cent. formalin mixture in absolute alcohol, etc.—and while I do not deny their efficacy I have always returned to the plan just laid down. Needles I sterilize and keep immersed in sterilized, soft paraffin. Suture materials are kept in various disinfectants and detergents. If of silk I prefer the so-called iron-dyed variety prepared with paraffin. It will be found to slip through the tissues with ease, to remain steadily in the eye-hole of the needle and not to become rotten or weak as soon as the ordinary kind.

I cannot praise too highly Boeckmann's dyed catgut sutures. They are of all sizes, are readily seen in the wound, are strong and do not break or get tangled, and (no small advantage) are absorbed by the tissues so that it is rarely necessary (to do what patients often regard in the light of a second operation) to remove them with scissors and forceps.

Although it is extremely important that instruments should be sterile, it is equally vital to the success of an operation that they be sharp, polished, and free from rust spots or other imperfections. Indeed, it is quite as desirable to be aseptic as antiseptic in our surgical precautions. The contents of the instrument case should be regularly inspected and the cutting instruments tested with a magnifying lens and drum, that any instrument may be repaired, or cleaned, and so made ready for instant use. I am in the habit of placing the instruments after use in an operation in very hot sterile water, or in a hot solution of sodic carbonate. From this liquid they are one by one removed, carefully wiped and polished with a soft cloth. The heat of the fluid in which the instrument was recently immersed afterwards serves to complete the drying process and so prevents dulling or rusting of the metallic surface. In the moist climate of Chicago I find it necessary to preserve all my instruments on the loosely arranged shelves of a closed (glass) cabinet in which a 36 candle electric lamp constantly burns. I find this method of drying the interior of the cabinet superior to the use of calcium chloride, etc.

#### **The Position of the Patient in Operating on the Eye.**

This is important. Some operators prefer the sitting position *in an operating chair* such as dentists use, but every valuable purpose is generally served by the employment of the ordinary surgeon's table—especially when a general anesthetic is given. A crescentic piece may be cut out of the table, corresponding to the left side of the patient's

chest when he is in the prone position. The body of the operator occupies this semilunar space, and he is thus enabled (especially if he is not ambidextrous) to face his patient and manipulate his instruments to greater advantage.

*Artificial light* is preferable to solar illumination for operations on the eye, because it is always to be depended upon, can be arranged to suit the operator and its brilliancy can be increased or decreased at will. A *covered hand lamp* is to be preferred, held and regulated by an assistant. Some operators prefer a *head (electric) light*, but I have never been able to use it with satisfaction. I have also rejected after trial the *illumination of the field of operation by means of a lens*, either stationary or held by an assistant.

Dor\* believes in the *prophylactic action of iodide of potassium* on intra-ocular infections and has given to each of the patients on whom he has operated for the past five years 3 to 4 grammes of iodide per day for two or three days, commencing the day before the operation, and has not had the slightest symptom of infection in any case.

#### Anesthetics.

*The great majority of ophthalmic operations can be performed under local anesthesia* (q. v.). Iridectomy made *during an attack of glaucoma*, when the eye is congested; enucleation and its substitutes; operations on the lids and most *operations on children* require a general anesthetic. Whether ether, chloroform, ethyl bromid, nitrous oxide or a combination of two or more of these is used, will depend upon the views of the anesthetist. (Read elsewhere in this System Dr. Peterson's practical suggestions on the subject.)

Quite recently the papers constituting a symposium on this subject and in particular a consideration of spinal anesthesia have been published in the *Journal of the A. M. A.* for Nov. 13, 1908. They fully reflect the latest views on this subject.

*General anesthesia.* Segelken\*\* advises the use of *Morphia-scopolamin narcosis combined with the local use of cocaine where general anesthesia with ether or chloroform is especially dangerous*. In a case of double acute glaucoma iridectomy was done on both eyes. The patient slept quietly during the operation and for several hours afterwards.

C. S. Venable† advises *spraying with a 1:400 solution of adrenaline* the inhaler or cone used in ether anesthesia. The adrenaline is carried into the air passages, astringes the vessels of the respiratory

\**Ophtal. Provinciale*, Dec., 1906.

\*\**Klin. Monatsblätter f. Augenheilk.*, July, 1907.

†*Virginia Med. Semi-Monthly*, Feb., 1907.

mucosa, lessens the secretion of mucus and so permits of better aeration of the bronchial tracts and pulmonary spaces.' He repeats the spraying every 6 or 8 minutes, from one-half to one ounce of the mixture being used during an average operation.

de Prenderville, senior anesthetist to the London Throat Hospital, in a letter (*The Ophthalmoscope*, Nov., 1908) suggests that in ophthalmic operations *ethyl chloride* is "admirable for the purpose; but so is chloroform itself, carefully given, and pushed, let me add, at the right moment. When great fear is present—a factor of serious import to the administrators—it is wise to go slow, often very slow; the vagus yields grudgingly at times. Personally, I distinguish between fear and fright; the one is the result, right or wrong, of a reasoned conviction; the other, found only in children, the product clearly of unusual surroundings, or more often due to unpleasant recollections of—shall we say—the surgeon? With the former state, I think it safer to use ethyl chloride in combination with nitrous oxide gas, a mixture which answers very well for short operations in adults, and patients generally above the age of twelve."

By far the best recent discussion of the question of general anesthesia will be found in the *Journal of American Medical Association*, November 7th and 13th, 1908. It is headed by a Preliminary Report of the Anesthesia Commission of the American Medical Association. These articles, that occupy considerable space in the *Journal*, should be studied by the reader, since for him they form, in conjunction with the chapter in this System by Dr. Peterson, a complete review of the whole subject.

Spilmeyer\* examined the central nervous system in thirteen subjects after death following *spinal anesthesia*. The fatalities were due to peritonitis, sepsis, or cachexia in from two days to a week, after the injection, except one case, in which the anesthesia was responsible, the patient dying in coma forty-eight hours after the operation. The histologic findings in these cases, and in considerable experimental research, showed degeneration in the motor ganglion cells of the anterior horn of the cord. These motor elements seem to be especially susceptible to the action of *stovaine*. The changes were observed in these cells high in the neck as well as low down, and in some the changes seemed to be irreparable. He adds that none of these changes were discovered in the cases in which the dose of 0.07 gm (0.9 grains) of *stovaine* had not been exceeded. In the fatal case 0.12 gm. (1.7 grains)

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\**Münchener Mediz. Wochenschr.*, Aug. 4, 1908.



stovaine had been injected; paralysis of the respiration was the first sign of danger.

**The Non-Operative After-Treatment of Normal Cataract Extraction, Iridectomy and Other Major Operations on the Eye.**

The following observations are the result of twenty years' experience in the after-treatment of cataract extraction. *They also apply largely to the majority of operations in which the eyeball is opened.*

There is a sense in which the healing process pursued by wounds involved in operations like the extraction of cataract may be described as normal. At any rate the subsequent course followed by the process of repair, the visual results, and the ultimate fate of the eye, are usually determined at the time of the operation.

Fortunately the cases in which, after removal of cataract, the final result is in every sense of the word good, where the normal healing process is not interrupted, and useful vision is obtained, are in the majority; but that the proportion of these can be still further increased by strict attention to the details of after-treatment, is my conviction.

After the extraction of senile cataract (if the operation be performed without iridectomy) the pupil should remain round, small, and central. It matters not what plan of extraction be followed, there should be no presentation of vitreous or iris between the lips of the corneal or scleral wound; there should be no undue loss of blood from, or continuous bleeding into, the anterior chamber—which should itself be free of lenticular or capsular detritus. The wound-edges should be neatly and closely applied to each other, and no extraneous matter—blood-clots, iridic, capsular, or lenticular debris—should be permitted to remain between them; there should be no collapse or wrinkling of the cornea, and no eversion of the wound-margins.

Assuming the operation to have been correctly performed, and that there are no complications, the question at once arises as to the advisability of *washing out the anterior chamber* for the purpose of expelling any remnants of blood, cortical matter or capsular tissue that have not been previously extracted. Although quite a number of operators are opposed to this method, there are still ophthalmologists of repute who advise it. If resorted to, the greatest care and gentleness should be exercised. Panas—who, by the way, abandoned the method which he was among the first to advocate—advised the use of a specially devised syringe, the point of which is to be introduced between the lips of the wound, and the anterior chamber flushed with one of the following solutions, all of which are to be sterile, free of particles, and *warm*:



℞

Boracis	4.00,
Acid. boric.	3.50,
Aquæ bullientis	100.00.

Or,

℞

Sodii chlor.	1.00
Aquæ dest.	100.00

Where an *antiseptic* is for any reason desired almost any of the well tried germicides may be used, but it must be remembered that a very lively reaction sometimes sets in even after the employment of the simplest irrigating liquid. For example:

℞

Hydrarg. bichlor.	0.01
Aquæ dest.	200.00

Shake well, and filter.

A less irritating mixture (also used warm) is:

℞

Formalin.	0.01
Aquæ dest.	50.00

Or,

℞

Acid boric.	3.5
Hydrarg. bichlor.	0.01
Aquæ dest.	100.00

All sorts of instruments besides Panas' syringe have been devised for the purpose of irrigating the anterior chamber.

Instead of using the syringe piston or bulb as the propelling force, I have been in the habit of flushing with the following apparatus: A pint bottle filled with the warmed irrigating fluid, and provided with a nozzle and stopcock at its bottom, is placed about four inches above the patient's head. Rubber tubing connects the bottle with the point of a Bowman's syringe. After the whole apparatus has been carefully sterilized, the syringe-point is placed within one angle of the operation wound, and the chamber is washed out by a stream from the bottle. The process is repeated at the outer wound-angle until the pupil becomes black and the chamber clear.

The whole length of the incision should now be closely examined with a lens for the purpose of detecting and removing any lenticular shreds, pieces of capsule, iridic pigment, vitreous beads, or minute

blood-clots, that have escaped the earlier inspection. When even very small tissue shreds are allowed to heal in the wound, they are prone to attach themselves also to the iris, to the posterior capsule, or to floating bodies left in the anterior chamber, and to greatly mar the final result. Not only that, but they establish a communication between the interior of the eye and the outside world, and thus sooner or later become the means of infecting the delicate parts within.

Knapp and others have warned us of the danger which attaches to massage of the cornea with the finger and lid-edges in attempts to remove any of the anterior-chamber contents. The free borders of the lids are the parts of the external ocular apparatus most difficult to sterilize and most crowded with pathogenic microbes. It has again and again been demonstrated bacteriologically that the palpebral edges remain infected long after the surrounding skin has been rendered fairly sterile. The cilia perform for the conjunctiva much the same office that the vibrissae do for the nasal mucosa, and the number and variety of bacterial colonies planted upon the free borders of the alæ nasi closely resemble those which we find infesting the skin about the eyelashes. Consequently, to rub, ever so lightly, the free edge of the lid over the freshly made wound in the cornea, is to invite infection of the latter.

Of all the instruments devised for *washing out the anterior chamber that of Lippincott*, and irrigators patterned after his original model, are probably the best. As just stated the greatest care should be employed in using them and when that is done they are certainly a decided advantage in many cases of cataract extraction.

The apparatus for flushing the anterior chamber just described (or some modification of it) may well be used for washing away foreign matter from the eyeball, sac, and lid-edges, before the final toilet is made. Instead of the syringe-point, a sterilized pipette or the glass end of a medicine-dropper may be employed. I have used for this purpose a warm one-per-cent. solution of common salt, and prefer it to the elaborately prepared antiseptics employed by some operators. As it is about as difficult to sterilize the conjunctival sac as it is to sterilize the lid-edges before operation, it may be accepted as truth that we cannot render it completely aseptic in the short time at our disposal after the removal of the lens.

Panas is of the opinion that the nearest approach to sterility of the lid edges that we can make is effected by the application (with a probe) to them of an oily solution of mercuric iodide. He advises its employment (and the use of occlusive bandages) for from twelve to twenty-four hours previous to the operation. If used *after* the ex-

traction it is to be applied to the free borders and palpebral skin. The formula is as follows:

R

Hydrarg. iodidi

0.01

Olei olivæ

40.00

#### Dressings in Major Operations on the Eye.

I have never seen any good result from the use of post-operative dressings applied directly to the eye in the form of powder. I have used finely pulverized boric acid upon the lids and lid-edges, and believe its action, when it had any at all, to have been entirely harmful. Still more am I opposed to "packing" the eye with that most objectionable of all the applications used in ophthalmic surgery—iodoform. Both these powders are likely to find their way between the lids to the eyeball, and, however finely divided, are almost certain to act as foreign bodies and to irritate the eye. They are at best but feeble antiseptics, while, in my opinion, considering the large number of effective and sweet smelling substitutes for it, iodoform should only be used when the patient is affected with a kindly anosmia.

If it be desired to affect the eye with drugs of any sort, now is the time to use them. It was once almost the universal custom to instill a one per cent. solution of eserine, when the simple extraction was chosen, for the purpose of contracting the pupil and so preventing prolapse of the iris. But as neither mydriatics nor miotics have any appreciable effect upon the muscular fibres of the iris so long as the anterior chamber is empty, this procedure has been pretty generally abandoned. This objection also holds true in respect to atropine, a useful agent in preventing adhesion of the iris to floating debris in the anterior chamber, and in incipient iritis. A decided mydriasis may, however, result from an instillation of atropine, even two or three days before the anterior chamber has re-formed, just as soon as it is again refilled. If applied at all, I am much in favor of employing these remedies in the form of ointment, smeared on the lids or on the dressing. Not only is a drug applied in this manner more uniform in its action, but it is decidedly more persistent than when exhibited in solution. Moreover, one also obtains the soothing effects of the greasy application to the lid-edges, preventing their adhesion if mucus is formed beneath the dressing, and allowing a ready escape of tears and other discharges.

We now come to the question of the dressings themselves. And first of all, shall we apply them to one or both eyes? Personally, I have never been able to see any reason for covering the sound eye after a normal cataract extraction. It has a very depressing effect

upon most patients, it does not prevent them from moving either eye underneath the bandage, and it does not in any way assist the healing process in the eye operated upon.

As to the form of the dressing, there is about the same difference of opinion to-day that existed in the time of von Graefe and Beer; one school cries out for heavy bandages and absolute rest, the other for liberty and no dressing. One extremist applies to both ocular regions a thick flannel or gauze bandage over pads of borated or even iodoform cotton, while the enthusiast of still another creed advocates a narrow strip of isinglass or other plaster, just large enough to keep the lids together. Doubtless each one of us considers his method to be the best, but even a superficial study of the course pursued by the healing process after cataract-extraction will show that the great majority of cases do well with any kind of bandages or with none at all, and I am therefore inclined to the one that gives most comfort to the patient. I do not think we should arbitrarily use any form of dressing in *all* cases. I usually prefer the following: A layer of borated or sterilized cotton, two or three millimeters in thickness, is placed between two single layers of sterilized gauze. Those are together cut out (so that they adhere and form one piece) with a pair of scissors, in oval form and of a size to cover the orbital openings, reaching from the eyebrows to below the inferior orbital margin. Three pieces of adhesive plaster, each three or four inches long, keep this dressing in place and are so arranged that no portion of them presses upon the eyeball. This is accomplished by placing the first over the upper border of the pad, and firmly attaching both to the skin above the *superciliary ridge*; the second is carried along parallel with the nose; the third completes the triangle. Such a bandage is not too thick and heavy, permits ventilation, does not (while filtering the air passing through it) press upon the eyeball, readily absorbs mucus, and cannot without discomfort to the patient be removed by an officious friend.

The patient should be carefully carried or wheeled from the operating-table, when he has not been operated on in his own bed, and placed in or upon his bed. Complete rest for the next twenty-four hours is now in order. He should be warned not to talk more than is absolutely necessary, not to make any sudden movement of his body, and to refrain absolutely from blowing his nose, squeezing his lids together, turning over or getting up suddenly, and above all, to abstain from sneezing or coughing. The last two acts are of course largely involuntary, but the patient should be encouraged to suppress them as much as possible.

The room should be made as comfortable as possible for the patient, especially in the matters of warmth, light and ventilation. Either before the operation or immediately after it he ought to have a full dose of potassic bromide or be given a small quantity of morphia and atropia hypodermatically. I exhibit the former if the patient is of a costive habit, and my formula is usually this:

R

Pot. bromidi	2.00,
Chloral. hydratis	1.00,
Syr. lactucarizæ	10.00,
Aquæ dest.	20.00.

This relieves the smarting and burning that almost always follow the operation, and enables the patient to rest quietly and contentedly. It also induces sleep the first night, and puts the bowels in a quiescent condition for forty-eight hours. The diet should be semi-fluid and easy of digestion.

What can be more provoking to the surgeon than to find, after obtaining a good operative result, that a careless nurse or a restless patient has added a newly opened corneal wound, a hernia of the iris, or los. of vitreous, to his other anxieties? A finger-thrust, a pillow-end jammed into the eye, a slight blow upon the globe, or any other of the dozen little accidents that happen to a person with imperfect vision moving about in darkened rooms, may nullify the most brilliant and correct effort of the operator. To avoid accidents of this sort, especially when night comes on, or when the patient begins to move about, the eye should be protected from injury by some sort of a shield or mask. Fuchs uses the wire-woven protector introduced as long ago as 1883. There are many modifications of this mask in the market, one of the best of which has been suggested by Würdemann.

Certain operators who make use of the roller bandage gain protection by starching the dressing. When this has dried, the eye will receive a considerable blow without injury.

Snellen used a turtle-shaped aluminum shield, about ten centimeters long and five wide, placed over the eye and held in position with strips of adhesive plaster; it forms an admirable protector. One of the best shields I am acquainted with is the Ring *papier maché* half-mask, which when carefully adjusted to the nose and surrounding parts makes a light, comfortable and effective protector.

A small proportion of patients object to wearing any sort of mask, claiming that it prevents them from sleeping and makes them nervous. In such cases I find that one may very well get along with

a large, stiff and very concave eye-shade placed over the dressing and held in place with a piece of rubber plaster.

*I am in favor of always removing the bandage and looking at the eye twenty-four hours after an extraction or other serious operation.* The corneal wound is now either altogether healed over, especially if a conjunctival flap has been made or, if not, the danger of prolapse of the iris has generally passed. That is to say, if no iridic hernia has occurred at the end of twenty-four hours, it is not likely to occur at all from any cause, except from violent sneezing, coughing, direct traumatism, etc. In cases of uncomplicated cataract-removal the lids at the end of twenty-four hours are not discolored or edematous. From a glance at them, one can generally predict the condition of the eye beneath. The discharge on the bandage should be watery only (or contain little mucus) and ought not to be copious. The main object, however, of the inspection is to determine the position of the iris. If prolapse has occurred, *now* is the best time to deal with it.

The eye should be gently bathed with boric acid solution, and any mucus, vaselin or ointment washed off the lids and cilia. This should be daily repeated. Solutions instilled into the eye must be neutral or slightly alkaline to test-paper, and always warmed.

When the corneal wound is healed and the anterior chamber re-established, the ordinary bandage may be dispensed with. I am in the habit of substituting for it a *concave* monocular eye-shade which, while touching the brow, cheek, and nose, is clear of the eyelashes. This is worn loosely over the eye during the day, and at night is kept in place by a small strip of adhesive plaster. In a week or ten days one may usually dispense with any dressing or protection whatever, particularly where the patient remains indoors.

On what day should the patient be allowed out of bed? In all ordinary cases twenty-four hours is long enough for him to maintain absolute rest. Still avoiding sudden movements he may then be allowed to sit up in an arm-chair and even to move about in the room, and so gradually regain his wonted liberty. After forty-eight hours the bowels should be moved by an enema, and more solid food is to be added to the diet list.

Common sense will dictate when and under what circumstances the subject of a major operation should venture out of doors. If exercise be taken in a close carriage, he may, with the eye wearing an ordinary shade, be allowed out, even in severe weather, as early as the end of the second week; when the day is comfortably warm and there is no wind blowing, walks may be taken with impunity.



After cataract extraction there should be absolutely no use of the eyes for a month, when glasses should be given for distance. As soon as the patient is accustomed to these, lenses for near work may be prescribed.

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## APPENDIX.

It is often desirable, in persons suffering from asthenopia due to *incompetent ciliary muscles*, to exercise them much as we do a weak musculature elsewhere—the adductive ocular muscles, for example. By such a plan one may regulate, at the same time, the amount of near work, the occasion and the circumstances under which it is done by the defective focusing apparatus.

As Dyer originally pointed out, it is well to begin by allowing the patient to read, or sew, three or four times a day a certain number of minutes just short of the time that commonly sets up asthenopic symptoms. Suppose he can read five minutes, but ten minutes' close application cause blurring or smarting, or eye ache? Let him, then, read five minutes (by the watch) four or five times a day; the second day six minutes four or five times daily; the next day seven minutes; the next, eight minutes, and so on. The patient should, while taking these exercises, always stop on the approach of symptoms, it matters not how short a time he has been reading or writing, and postpone until the following period his efforts to do near work. After each exercise is a good time to apply soothing collyria, cold water, evaporating lotions, etc., to the eyes and ocular region. These exercises and the other treatment for the asthenopia should be continued until the patient is able to do a fair amount of near work without discomfort.

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